SYSTRON DONNER

INSTRUCTION MANUAL

MODEL DPSD-50
DIGITAL POWER SOURCE

SERIAL NO.

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SYSTRON DONNER CORPORATION

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THIS EQUIPMENT WAS TO: ☐ Replace existing instrument ☐ Expand equipment capability

WHAT INFLUENCED YOUR DECISION TO BUY? ☐ Advertising ☐ Salesman ☐ Other

COMMENTS: _____

Change Table 2-4 page 2-4 Input Data Codes as follows:

Change 0000 0.03 to
0000 0.04

Change paragraph 5.4.2.14 page 5-12 as follows:

14. Program all 16 steps of the Over Current and verify that the source current limits at its correct value as indicated in the following Table. All levels are:

a) ±5% or ±10 mA whichever is greater.

b) -0.4 mA/V of output voltage.

Over Current Switch BCD Setting	Current Limiting Level in Amperes
0000	0.04
0001	0.11
0010	0.18
0011	0.25
0100	0.32
0101	0.39
0110	0.47
0111	0.54
1000	0.62
1001	0.69
1010	0.75
1011	0.82
1100	0.89
1101	0.96
1110	1.03
1111	1.10

Change para. 5.4.3.14 page 5-15 to read as stated in corrected para. 5.4.2.14 above.

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CHAPTER 1
GENERAL INFORMATION

1.1 INTRODUCTION

DPSD-50. DPS = Digital Power Source. D = Dual. -50 = 50 Volt Output.

The Digital Power Source (DPSD-50) is a programmable power supply having two independent and isolated regulated precision dc power supplies, digitally controlled via a computers I/O circuits. Digital control to provide fast, accurate settings, of specific dc voltage outputs. It is intended for use in automated test systems, process control and similar applications where the dc power output must be rapidly reset from IC logic levels of computers, minicomputers or peripherals.

The DPSD-50 has built-in addressable memory whose functions can be independently programmed by the same data lines serving other peripherals. This feature reduces the number of computer I/O circuits required when more than one power supply is programmed. Up to 32 power sources can be programmed via a single I/O section. The DPSD-50 contains an internal digital controller and a precision power supply. The digital input from the computer or comparable source is converted internally to a precision analog command for the programmable power supply. No external buffers, data converters, or other interface items are required with the DPSD-50 as all buffering and D/A functions are performed internally.

The digital controller programs; the DPSD-50 output voltage, the over voltage and over current limits, the output polarity and range (resolution) functions. It has a addressable memory that responds to only one of 32 possible address codes. Each function is controlled by a binary address controller. Front panel manual switches are provided so that any one of the 32 possible addresses can be pre-assigned by the operator. The controller is electrically isolated from the power supply to eliminate ground loops and allows the power supply outputs to be floated from the digital inputs and from each other.

1.2 GENERAL FEATURES

The DPSD-50 is provided as a dual channel power source. Each unit has front panel output voltage and output current meters with a channel selector switch to allow direct reading of either power source outputs. An LED four digit display is provided to visually verify programmed voltage outputs for each of the supplies. The unit is designed for standard EIA rack mounting in a 19-inch rack. Internal over current protection is provided for each source with an indicator lamp on the front panel to display an over current condition. All manual operating controls are front panel mounted with all interface connections, such as ac power, digital input and output, and voltage outputs rear panel mounted.

1.3 PRECAUTIONARY MEASURES

Certain precautionary measures such as wire size and use of regulators or inverters must be considered in respect to normal operation of the DPSD-50.

Wire size - It is very important to take into consideration the physical wire size and current handling capability of the input power line to ensure proper regulation under all load conditions and to prevent distortions of ac line voltage input. Underrated or overloaded ac input lines may result in increase ripple content and/or severe losses in regulation. Maximum ac impedance from the circuit breaker or disconnect switch to the power source input should not exceed 0.75 ohms.

Voltage Regulators or Inverters as ac sources - Do not use voltage regulators or inverters as primary ac power sources. Outputs of these devices are not usually sinusoidal in nature, and, if used as the ac power source for the DPSD-50 may cause serious loss of regulation of the power supply output. Capacitive input filtering used for semiconductor power supplies requires charging to the peak of the rectified ac wave which non-sinusoidal ac sources may not provide.

TABLE 1-1 SPECIFICATIONS

DC Output:	
Voltage X.1 Range:	-9.999 to +9.999 volts.
Voltage X1 Range.	-50.00 to +50.00 volts.
Maximum Current:	1 amp, each output.
Resolution:	
X.1 Range:	1 millivolt.
X1 Range.	10 millivolts.
Basic Accuracy (90 days) 23°C ±3°C, 115 Vac in, no load, 30 minutes warm up.	
X.1 Range:	1 millivolt.
X1 Range:	10 millivolt.
Stability: 8 hours after 30 minutes warm up constant line, load and temperature.	
X.1 Range:	300 microvolts.
X1 Range:	1.5 millivolts.
Ripple and Noise any line and load:	
X.1 Range:	2 millivolts peak-to-peak, 0.5 millivolts rms.
X1 Range:	5 millivolts peak-to-peak, 1.25 millivolts rms.
Load effect, Vout change for any load change:	
X.1 Range:	<500 microvolt.
X1 Range:	<500 microvolt.
Source effect, change in Vout for any line change:	
X.1 Range:	<200 microvolt.
X1 Range:	<200 microvolt.

TABLE 1-1 SPECIFICATIONS (Contd)

Temperature Coefficient	
change in Vout per °C	
change in ambient temperature	
X.1 Range:	150 microvolts/°C.
X1 Range:	1.5 millivolts/°C.
Programming Time	
To 0.1% of programming change	
Sign Change:	<10 milliseconds.
Range Change:	<5 milliseconds.
Other:	<2 milliseconds.
Power Requirements:	115 Vac or 230 Vac ±10% 50-400 Hz.
Physical Characterisitcs:	
Size:	5.25"x19"x21" (HxWxD) 13.33 cm x 48.26 cm x 53.34 cm (HxWxD)
Weight:	42 pounds. 19.05 kg.

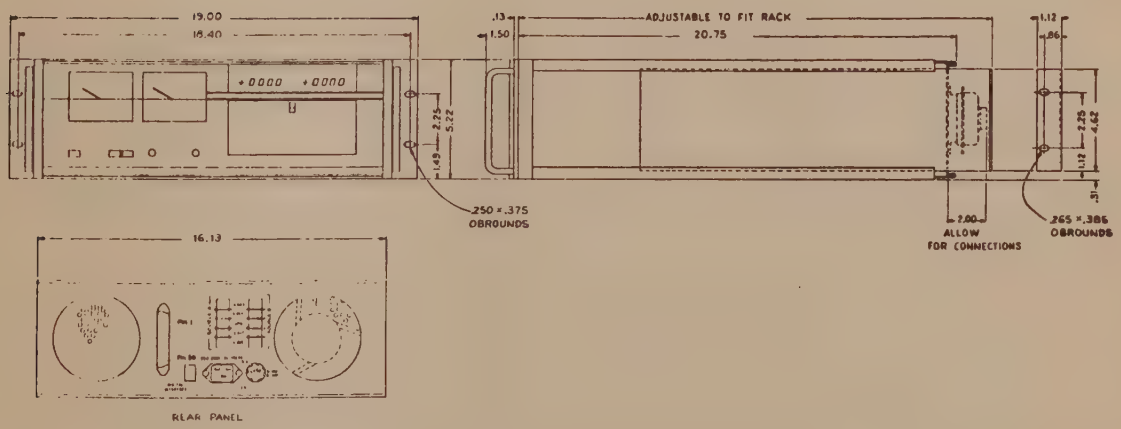

FIGURE 1-1 OUTLINE DRAWING MODEL DPSD-50

CHAPTER 2
INSTALLATION

2.1 INTRODUCTION

Procedures for inspection and initial installation of the DPSD-50 are outlined in this chapter. Reshipment instructions have been included should the instrument require return to Systron-Donner Corporation.

2.2 RECEIVING INSPECTION

Before accepting the instrument from the shipper, inspect the shipping container for signs of external damage. Any sign of such damage should be noted by both the shipper and customer; then, should be reported to the insurance investigator.

As soon as the instrument is unpacked, inspect it for shipping damage. Check for scratches or dents, broken or cracked knobs, and damaged connectors. Should any damage be found, notify your nearest Systron-Donner representative. Do not use the instrument until instructed to do so by the representative.

2.3 INSTALLATION

Installation of the DPSD-50 includes power connection, source connection, digital interface and verification of internal cooling.

2.3.1 Power

The DPSD-50 may be operated from a 115 or 230 volt ac ±10%, 50-400 Hz power source. Conversion from one source to the other is accomplished by changing the rear panel 115/230 power switch to its respective setting and installing the appropriate fuse.

The instrument is factory-supplied with a 3A 3AG fuse for 115 Vac operation. Be sure to replace this fuse with a 1.5A 3AG fuse when operating with 230 Vac.

CAUTION

Before connecting instrument into ac power line, be certain that the power switch is set for the proper voltage.

The DPSD-50 is equipped with a detachable standard three-conductor power cord that automatically grounds the unit when a matching power outlet is available. An adapter which provides the instrument ground should be used whenever the power cord is connected to a two-conductor outlet.

The power handling capability of the ac power line to the line cord must be considered. Undersized or overloaded lines can cause serious losses in regulation and/or substantial increases in ripple content of the DPSD-50 dc output. The ac impedance from the circuit breaker or disconnect switch should not exceed 0.75 ohms. All ac power line connections must be tightened securely. If a variable transformer or equivalent device with movable electric contact surface is used, the contact should be kept clear of impedance-producing oxide coatings.

Care should be exercised in selecting proper wire size for the ac input lines. Table 2-1 is a convenient reference guide for input wire size.

TABLE 2-1 AC INPUT WIRE SIZE

Length of Run (Single Lead)	Wire Size (AWG Standard)
10 feet or less	18
10 to 20 feet	16
20 to 50 feet	14
50 to 100 feet	12

2.3.2 Source Outputs

The dc source outputs are taken from a 5-point terminal barrier strip. The barrier strip provides voltage and sensing out and return, and ground connections for each power source.

Shorting links and programming applications. The power source is shipped from the factory with shorting links across the terminals of the terminal barrier strip for each power source for local sensing and regulation. Table 2-2 lists shorting link applications.

TABLE 2-2 SHORTING LINK APPLICATIONS

TERMINAL	CONDITION	FUNCTION
V RET and S RET S OUT and V OUT	Connected Connected	Local sensing and regulation, load connected to V RET and V OUT
V RET and S RET S OUT and V OUT	Not Connected Not Connected	Remote sensing and regulation at load; leads connected to V RET and V OUT for load, and individual leads to load from S RET and S OUT
GND		Chassis ground

NOTE

If connections (links or direct leads) are not made to terminals S RET and S OUT, the output voltage will become unregulated. However, the unit will not become damaged by failure to connect the sensing leads to the load, either locally or remotely.

2.3.3 Digital Interface Connection

All digital data, input and output, connections are made through the 50-pin Digital Interface connector on the rear panel. Table 2-3 gives the pin designation for wiring of the digital interface connector. Tables 2-4 and 2-5 provide the respective overvoltage and overcurrent input data codes.

2.3.4 Cooling

The Model DPSD-50 dual power source uses forced air cooling. The air intake is located on the rear panel, ensure the intake filter is clean and in place before applying power. Under no circumstances should the air intake be obstructed while the instrument is operating.

2.4 RESHIPMENT

Should it become necessary to reship the instrument, contact the nearest Systron-Donner field office for shipping instructions. If possible, use the original packaging materials, or replace the packing in accordance with MIL-P-116 and MIL-E-17555E. The field office can provide materials similar to those used for the original factory packaging. All correspondence should refer to the full nomenclature and serial number of the instrument. This information is normally contained in the instrument serial number tag attached to the rear panel.

TABLE 2-3 DIGITAL INTERFACE CONNECTOR

PIN	FUNCTION	PIN	FUNCTION
1	8 bit MSD	26	Digital Gnd
2	4 bit MSD	27	Parity In
3	2 bit MSD	28	Digital Gnd
4	1 bit MSD	29	Digital Gnd
5	8 bit SD-2	30	Digital Gnd
6	4 bit SD-2	31	Digital Gnd
7	2 bit SD-2	32	Parity Out
8	1 bit SD-2	33	Over Current A Flag
9	8 bit SD-3	34	Ready A Flag
10	4 bit SD-3	35	Spare
11	2 bit SD-3	36	Digital Gnd
12	1 bit SD-3	37	Digital Gnd
13	8 bit LSD	38	Digital Gnd
14	4 bit LSD	39	Digital Gnd
15	2 bit LSD	40	Over Current B Flag
16	1 bit LSD	41	Ready B Flag
17	16 bit DPS Address	42	Spare
18	8 bit DPS Address	43	Digital Gnd
19	4 bit DPS Address	44	Digital Gnd
20	2 bit DPS Address	45	Digital Gnd
21	1 bit DPS Address	46	Spare
22	2 bit Function Address	47	Digital +5V
23	1 bit Function Address	48	Continuity
24	Spare	49	Continuity
25	STROBE	50	Digital Gnd

TABLE 2-3 DIGITAL INTERFACE CONNECTOR (Contd)

NOTES:

1. In the Remote Mode functions are addressed sequentially and a separate Strobe is required to input each of the four functions.

2. Function Address is used to program the desired function as follows:

FUNCTION ADDRESS CODES TRUTH TABLE

2 bit	*1 bit*	*Function*
0	*0*	*Output Voltage*
1	*0*	*Over Voltage*
0	*1*	*Over Current*
1	*1*	*Range/Polarity*

a. The MSD data lines are used to program the Over Voltage and Over Current limits.

b. The MSD 1 bit data line is used to program Polarity.
1 = + 0 = -

c. The MSD 2 bit data line is used to program Range.
1 = X0.1 0 = X1

TABLE 2-4 REMOTE DATA INPUT CODES NOMINAL OVERCURRENT LEVELS

INPUT DATA	OVERCURRENT LEVEL	INPUT DATA	OVERCURRENT LEVEL
0000	0.03	1000	0.62
0001	0.11	1001	0.69
0010	0.18	1010	0.75
0011	0.25	1011	0.82
0100	0.32	1100	0.89
0101	0.39	1101	0.96
0110	0.47	1110	1.03
0111	0.54	1111	1.10

TABLE 2-5 REMOTE DATA INPUT CODES NOMINAL OVERVOLTAGE LEVELS

INPUT DATA	OVERVOLTAGE LEVEL	INPUT DATA	OVERVOLTAGE LEVEL
0000	5.2	1000	32.4
0001	8.6	1001	35.8
0010	11.9	1010	39.1
0011	15.3	1011	42.5
0100	18.8	1100	46.0
0101	22.2	1101	49.4
0110	25.6	1110	52.8
0111	29.0	1111	56.0

NOTE: An overvoltage condition will cause the output voltage to drop to zero. Front panel voltmeter will read zero and the ampmeter will read the overcurrent level. To restore the instrument to normal when operating in remote mode the DPSD-50 must be sequentially programmed, first for zero volts operation, then to the desired output voltage. The zero volt programming is required to restore internal circuits to their quiescent state.

CHAPTER 3
OPERATION

3.1 INTRODUCTION

This chapter identifies the SD Model DPSD-50 controls, connectors and indicators. Initial turn-on and operational checks as appropriate are included, with step-by-step operating procedures.

3.2 CONTROLS, CONNECTORS AND INDICATORS

3.2.1 Front Panel

Front panel controls and indicators are listed and described in Table 3-1 and shown on Figure 3-1.

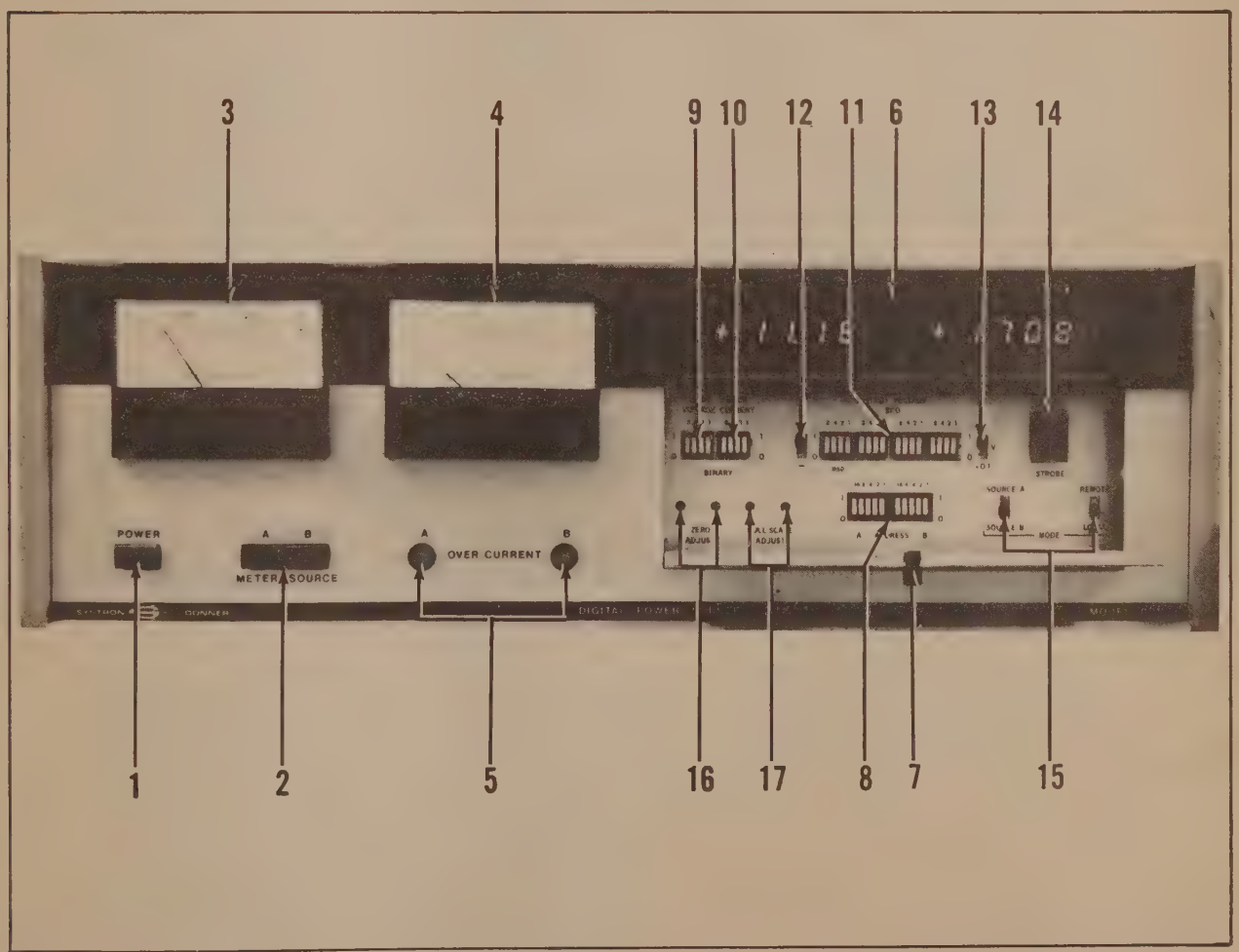

FIGURE 3-1 FRONT PANEL CONTROLS AND INDICATORS

TABLE 3-1 FRONT PANEL CONTROLS AND INDICATORS

INDEX	NAME	FUNCTION
1	POWER switch	On-Off switch applies power to the unit.
2	METER SOURCE A B selector switch	Selects which power source the voltmeter and ammeter are reading.
3	DC VOLTS meter	Displays sense voltage of selected power source. Will read zero if over voltage condition exists.
4	DC AMPERES meter	Displays dc load current of selected power source.
5	OVER CURRENT indicators	One each indicator lamp for the A and B channels, illuminate when the respective power source has exceeded the preset value of output current.
6	PROGRAMMED VOLTS A B	Four digit LED display with decimal point and polarity sign. (Displays the content of the memory.) One each display for the A and B channels respectively.
7	Access Door	Cover to protect local operating controls.
8	ADDRESS A B used in Remote Mode	Set of five switches per channel selects 16-8-4-2-1 binary coded address for each channel. Allows selection of the appropriate channel, out of 32 possible, from a common input bus when in the Remote Mode.
9	OVER VOLTAGE BINARY switches used in Local Mode	Set of four switches to set binary program code for overvoltage limits.
10	OVER CURRENT BINARY switches used in Local Mode	Set of four switches to set binary program code for overcurrent limits.
11	OUTPUT VOLTAGE BCD switches used in Local Mode	Four sets of four each BCD selector switches for output voltage programming.
12	+ - switch used in Local Mode	Polarity switch programs power source for plus or minus polarity output levels.
13	X1 X0.1 V switch used in Local Mode	Range switch programs the output voltage for 0.001 resolution in the X0.1 position and 0.01 resolution in the X1 position. Also programs the appropriate decimal point position on the LED display.
14	STROBE switch	Transfers into memory, all data set on the appropriate function switches as controlled by the Mode switch, when pressed.

TABLE 3-1 FRONT PANEL CONTROLS AND INDICATORS (Cont'd)

INDEX	NAME	FUNCTION
15	MODE switches	
	SOURCE A B	Selects appropriate source for input programming data as set on the function switches.
	REMOTE LOCAL	Selects either local or remote operating mode.
		In the Local position allows loading of the Function switches data into memory of the selected Cource upon execution of a strobe command.
		In the Remote position the Address code, takes the place of the Source A B switch and transfers data into the appropriate memory as controlled by the Function Address Code and the Strobe command.
16	ZERO A B adjustment controls	Provides for front panel zero calibration of each power source. Recessed screwdriver adjustments.
17	FULL SCALE A B adjustment controls	Provides for front panel full scale calibration of each power source. Recessed screwdriver adjustments.

3.2.2 Rear Panel

Rear panel controls and connectors are listed and described in Table 3-2 and shown on Figure 3-2.

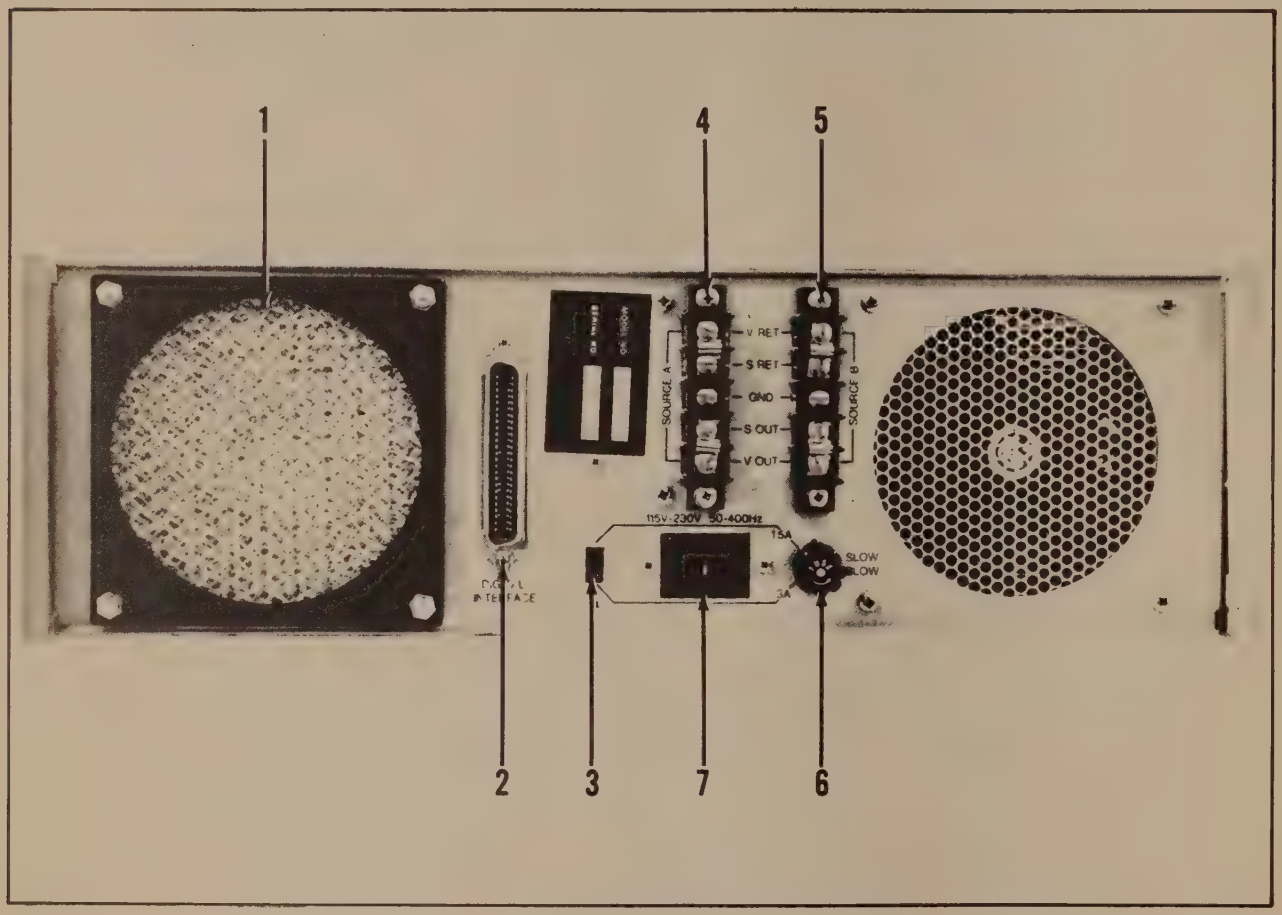

FIGURE 3-2 REAR PANEL CONTROLS AND CONNECTORS

TABLE 3-2 REAR PANEL CONTROLS AND CONNECTORS

INDEX	NAME	FUNCTION
1	Filter	Intake filter for forced air cooling. Filter screen should be cleaned periodically.
2	DIGITAL INTERFACE Connector	Remote programming 50 pin connector. Provides input and output data for the DPSD-50. See Table 2-3 for pin configurations.
3	115V - 230V Slide Switch	Line switch sets instrument for 115 Vac operation or 230 Vac operation.

TABLE 3-2 REAR PANEL CONTROLS AND CONNECTORS (Cont'd)

INDEX	NAME	FUNCTION
4	SOURCE A Terminals	Five terminal barrier strip provides output connection for Voltage and Sense Out, Voltage and Sense Return, and Ground between the DPSD-50 and the load for channel A.
5		Shorting links in place provide for local sensing and regulation at the DPSD-50 output. See Table 2-2 for complete wiring instructions.
5	SOURCE B Terminals	Five terminal barrier strip provides output connection for Voltage and Sense Out, Voltage and Sense Return, and Ground between the DPSD-50 and the load for channel B. Shorting link application is the same as channel A.
6	SLOW BLOW Fuse	Fuse holder for line fuse, use 3A fuse if operating on 115 Vac and 1.5A fuse for 230 Vac.
7	115V - 230V 50-400 Hz	Three pin ac line connector with an integrated line filter.

3.3 INITIAL TURN-ON AND OPERATING CHECK

The following procedures verify operation of the DPSD-50 prior to on-line usage. Successful completion of these checks will provide overall operational confidence in the unit.

In these procedures the object will be to program each source, first in the local mode then in the remote mode. The specific goals are: In the local mode to set Source A to +15.55 volts on X1 range with an overvoltage lever of 56 volts and a overcurrent level of 1.1 Amps. To set Source B to -12.5 volts X0.1 range with an overvoltage level of 56 volts and an overcurrent level of 1.1 Amps. In the remote mode to set Source A to +47.77 volts on X1 range with an overvoltage level of 56 volts and an overcurrent level of 1.1 Amps. To set Source B to -5.555 volts on X0.1 range with an overvoltage level of 56 volts and an overcurrent level of 1.1 Amps. Also, in the remote mode an arbitrary Address code of 23 for Source A and 7 for Source B has been assigned.

1. Connect the DPSD-50 to a 115 Vac source.

CAUTION

Be sure line switch on the rear panel is in the 115 Vac position.

2. Grounding - Either side of the power source may be grounded, or the output may be used in a floating condition.

3. Connect shorting links for local sensing, normally shipped in this configuration, shorting links connected between V RET and S RET and links between S OUT and V OUT.

4. Connect interface control cable to rear panel DIGITAL INTERFACE connector.

5. Press POWER switch ON. Initial turn on will force output voltage level to zero.

6. Set the METER SOURCE to A.

7. Program an Output Voltage with Overvoltage and Overcurrent to a maximum level for initial operation check. On the control panel behind access door:

Set REMOTE/LOCAL switch to LOCAL.
Set SOURCE A/SOURCE B to SOURCE A.
Set +/- polarity switch to +.
Set x1/x0.1 V range switch to x1.
Set OVER VOLTAGE and OVER CURRENT switches to 1111.
Set OUTPUT VOLTAGE BCD switches for 15.55 volts. MSD to 0001 (binary 1); SD-2 to 0101 (binary 5); SD-3 to 0101 (binary 5) and LSD to 0101 (binary 5).

8. Press the STROBE switch and observe the visual display. The A channel digital display should change to +15.55 and the DC VOLTS meter should read around 15.55 as discernible.

9. Set the METER SOURCE to B.

10. Set SOURCE A/SOURCE B to SOURCE B.

11. Set the +/- polarity sign to -.

12. Set the OUTPUT VOLTAGE BCD switches for 12.5 volts. MSD to 0001 (binary 1); SD-2 to 0010 (binary 2); SD-3 to 0101 (binary 5); and LSD to 0000 (binary 0).

13. Press STROBE and observe the visual display. The A channel display should remain at +15.55; the B channel display should change to -12.60 and the DC VOLTS meter should indicate around 12.5 as discernible.

14. This completes a simple confidence check on the DPSD-50 in local mode operation.

15. Set REMOTE/LOCAL to REMOTE.

16. Set ADDRESS A switches to binary 23, (10111). Set ADDRESS B switches to binary 7, (00111).

17. Program the following inputs to the DIGITAL INTERFACE data lines. See Table 2-3 for digital interface wiring and pin designations and Tables 2-4 and 2-5 for overcurrent and overvoltage level coding data.

18. Set binary 23, (10111) on the DPSD-50 Address data lines. This will select channel A when strobed.

19. Set binary 2, (10) on the Function Address data lines. This will select the overvoltage function when strobed.

20. Set 1111 on the MSD data lines. This will set the overvoltage level (56 volts) when strobed.

21. Generate a strobe command on the STROBE data line to transfer the aforementioned overvoltage data into the A Source on the DPSD-50.

22. Set binary 1, (01) on the Function Address data lines. This will select the overcurrent function when strobed.

23. Set 1111 on the MSD data lines. This will set the overcurrent level (1.1 Amps) when strobed.

24. Generate a strobe command on the STROBE data line.

25. Set binary 3, (11) on the Function Address data lines. This will program the DPSD-50 for Polarity and Range selection when strobed.

26. Set binary 1, (0001) on the MSD data lines. This will select + polarity and x1 range when strobed.

27. Generate a strobe command on the STROBE data line.

28. The A channel digital display should position the decimal XX.XX and indicate a + sign.

29. Set the Function Address to 00, output voltage code.

30. Set binary 4, (0100) on the MSD data lines, binary 7, (0111) on SD-2 data lines, binary 7, (0111) on the SD-3 data lines and binary 7, (0111) on the LSD data lines.

31. Generate a strobe command on the STROBE data line and observe the visual display.

32. The A channel display should indicate +47.77.

33. Set METER SOURCE to A. The DC VOLTS meter should read about 47.7.

34. Set binary 7, (0111) (selects channel B) on the DPSD-50 Address data lines.

35. Set binary 2, (10) (overvoltage function) on the Function Address data lines.

36. Set 1111 (overvoltage level) on the MSD data lines.

37. Generate a strobe command on the STROBE data line.

38. Set binary 1, (01) (overcurrent function) on the Function Address data lines.

39. Set 1111 (overcurrent level) on the MSD data lines.

40. Generate a strobe command on the STROBE data line.

41. Set binary 3, (11) (POLARITY/RANGE) on the Function Address data lines.

42. Set binary 2, (10) (- POLARITY/x0.1 RANGE) on the MSD data lines.

43. Generate a strobe command on the STROBE data line.

44. The B channel digital display should position the decimal X.XXX and indicate a - sign. The A channel should not change.

45. Set the Function Address code to binary 0 (output voltage).

46. Set binary 5 (0101) on the MSD data lines, binary 5 (0101) on the SD-2 lines, binary 5 (0101) on the SD-3 lines and binary 5 (0101) on the LSD data lines.

47. Generate a strobe command on the STROBE data lines and observe the visual display.

48. The B channel display should indicate -5.555. The A channel should not change.

49. Set METER SOURCE to B. The DC VOLTS meter should read about 5.5.

50. This completes a simple confidence check of the DPSD-50 in a remote mode operation.

The preceding procedure did not attempt to set the overvoltage and overcurrent limits to a specific level other than maximum, in that, no visual indication is immediately apparent on the visual display. However, it is necessary that some level is set as the first step, since, each time the DPSD-50 is turned ON the output voltage levels are forced to zero while the overcurrent and overvoltage registers may come up with any arbitrary number, thus, preventing proper loading of the output voltage level should this arbitrary value be less than the selected output.

3.4 OPERATING PROCEDURES

The following outlines the general method for operating the DPSD-50. Performing the initial turn-on procedure is recommended and will normally introduce the operator to the respective operating controls. After installation in a system, operation is normally in the Remote Mode using the system I/O devices to program (operate) the DPSD-50. Manual programming in the Local Mode provides for system troubleshooting, calibration and operation during computer down time.

3.4.1 Operation Configuration

Operation after installation is from the front panel. The load, however, may be connected to the DPSD-50 in either the local or remote sensing configutation. Common practice is to wire the system in the remote sensing configuration.

Local Sensing - Shorting links are connected between V RET and S RET and between V OUT and S OUT with the load wired to V OUT and V RET.

Sensing at the load - Shorting links are removed and the load is connected to V OUT and V RET. Separate sensing leads are connected across the load and to S OUT and S RET. Observe polarity markings for load and sense leads.

3.4.2. Remote Mode Operation

Placing the LOCAL REMOTE MODE switch in the REMOTE position removes all front panel operating controls other than the ADDRESS switches and transfers operation to the I/O devices connected to the Digital Interface data bus. The binary coded address set on the A and B channel address switches must be matched by the I/O's in order to initiate or modify a command. Digital data input are presented in parallel, representing Address, Function Address and Strobe.

To program the respective power source to an initial output level or to make any changes when in the REMOTE MODE the four operational functions must be inputted in series. The sequence is not mandatory, however, since the output voltage MSD data lines are used to select range, polarity, overvoltage limit, overcurrent limit, and output voltage, the output voltage is normally sequenced last.

In order to initiate or modify a command the following sequence of events occurs:

1. Digital data input, in parallel, representing the correct DPS Address, the Function Assress for Range/Polarity, the Output Voltage MSD 1 and 2 bits for range and polarity selection and the Strobe command are all present.

2. Digital data input, in parallel, representing the correct DPS Address, the Function Address for overvoltage, the Output Voltage MSD data for the overvoltage limit and the Strobe command are all present.

3. Digital data input, in parallel, representing the correct DPS Address, the Function Address for overcurrent, the Output Voltage MSD data for the overcurrent limit and the Strobe command are all present.

4. Digital data input, in parallel, representing the correct DPS Address, the Function Address for Output Voltage, the four digits of BCD data (16 lines) representing the Output Voltage magnitude and the Strobe command are all present.

When the strobe line goes high, the levels at the address and function input lines are accepted. These levels must remain unaltered until the strobe signal ceases (goes low). After strobe termination, all other digital inputs will be ignored. They may remain at the levels existing during strobe, or may be altered in any arbitrary sequence at arbitrary times. The values existing during strobe are retained i indefinitely.

3.4.3 Local Mode Operation

Placing the REMOTE LOCAL MODE switch in the LOCAL position transfers control of the DPSD-50 to the front panel. The Address A B control is replaced by the SOURCE A/ SOURCE B switch. Program changes are initiated at the front panel and inputted simultaneously by pressing STROBE. Once programmed changes to the respective switches are ignored until a new strobe command is generated. To program the DPSD-50 in the Local Mode proceed as follows:

1. Set SOURCE A/SOURCE B MODE swtich to SOURCE A.

2. Establish the output voltage magnitude, polarity, range and overvoltage and overcurrent limits, and set the respective switches as required.

3. Press STROBE.

This will program the A channel. Place the SOURCE A/SOURCE B MODE switch to SOURCE B and repeat the procedure to program channel B.

3.4.4 Internal Controls

Two adjustment controls per channel are accessible through the front panel Access Door. These are the Zero Adjust and Full Scale Adjust for each power source. All controls have been factory set and normally require no additional adjusting. If, however, changes are required for any internal controls because of component replacement, follow the calibration procedure given in this manual.

CHAPTER 4

PRINCIPLES OF OPERATION

4.1 INTRODUCTION

This chapter describes the functional operation of the DPSD-50 Digital Power Source from three perspectives. The overall functional operation of the Digital Power Source from a block diagram analysis discussed first, and is referenced to Figure 4-1 DPSD-50 Functional Block Diagram. A detailed description at the circuit and or logic level is presented next. This detailed theory of operation is formatted to the PCB plug-in assemblies that plug into the Digital and Analog Mother PC Boards, and is supported by the schematic diagrams located in Chapter 6 of this manual; and last the IC's used in the Digital Power Source are listed and described as to their characteristics and supported by the IC Data Sheet, which provides pinning information, schematic equivalents and any detailed characteristics that are unique to the IC device.

4.2 FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

The following functional description is referenced to Figure 4-1 DPSD-50 Functional Block Diagram. The assemblies that make up the DPSD-50 are listed in Table 4-1 as to Functional Name, Assembly, Part Number and Assembly Reference Designator if assigned (the plug-in PCB's are the only assemblies assigned referenced designators).

TABLE 4-1 DPSD-50 FUNCTIONAL ASSEMBLIES

FUNCTIONAL NAME	ASSY. PART NO.	ASSY. REF.
Digital Mother Board Assembly	055970	--
Analog Mother Board Assembly	055971	--
Main Chassis Assembly	055898	--
Right Gusset Heat Sink Assembly	057090	--
Left Gusset Heat Sink Assembly	057089	--
Front Panel Assembly	055896	--
Rear Panel Assembly	057092	--
Sign and Over Voltage (Source B) PCB Assembly	05590401	A1
Sign and Over Voltage (Source A) PCB Assembly	05590401	A2
Power Amplifier and Over Current (Source B) PCB Assembly	05593801	A3
Power Amplifier and Over Current (Source A) PCB Assembly	05593801	A4
Digital to Analog Converter (DAC) (Source B) PCB Assembly	05596901	A5
Digital to Analog Converter (DAC) (SOURCE A) PCB Assembly	05596901	A6
Digital Programming PCB Assembly	05596801	A7
Digital Input PCB Assembly	05596701	A8
Control and Display PCB Assembly	05593001	A9

The Power Source is functionally divided into two major sections Digital and Analog and relates to the two Mother PC Boards. The Digital Mother PCB is located on the right side of the instrument and mounts the Plug-in PC Boards A5 through A9, power supply rectifier diodes CR3 through CR14 and filter capacitors C4 through C15. The Analog Mother PCB located on the left side of the instrument mounts the Plug-in PC Boards A1 through A4. The Main Chassis Assembly provides for the mounting of the two Mother PC Boards, Power Transformers T1 and T2, rectifier diodes CR1 and CR2 and filter capacitor C1. The Right Gusset Heat Sink Assembly contains the components that relate to the logic power supplies, transistor Q1 and voltage regulators U1 through U7. The Left Gusset Heat Sink contains the power source regulator transistors for the A and B power sources Q2 through Q7, the over voltage SCR's CR15 and CR16 and the thermal protection switch S3. The Rear Panel Assemblies contain the two 5 terminal barrier strips TP1 and TP2 that provides the voltage output and sense interface to the load, the ac line fuse F1, the 115-230 volt line voltage selector switch S2, the input ac line connector and filter assembly, the digital interface connector, and the blower/filter assembly which provides the forced air cooling. The Front Panel Assembly contains the line power and meter source switch assembly S1, the volt and ampere meters, and the two over current indicator lamps DS1 and DS2. All the controls and the display for local operation and remote control are located on the Control and Display PCB Assembly A9 and are operated via the Access Door in the front panel. A window in the front panel provides viewing of the LED programmed volts display which is mounted on assembly A9.

4.2.1 Digital Section Functional Description

The Digital Input PCB Assembly A8 selects the data, address and function programmed by the switches located on the Control and Display PCB Assembly A9, when the LOCAL/REMOTE line is set low (signal ground) by placing the REMOTE-LOCAL switch in its LOCAL position. The data is then applied to the Digital Programming PCB Assembly A7 along with four of the eight strobes when the local STROBE line is momentarily set to a logic low by pressing the STROBE pushbutton switch.

When the LOCAL/REMOTE line is set high (+5 V) by placing the REMOTE-LOCAL switch in its REMOTE position, the Digital Input PCB Assembly A8 selects the data, address and function BCD's applied to the Digital Interface Connector J1 by the remote device. The data is then applied to the Digital Programming PCB Assembly A7, along with one of the eight strobes when the strobe pulse is generated by the remote device. An even parity check is performed on the data exchange via the PARITY IN and PARITY OUT lines.

The Digital Programming PCB Assembly A7 generates the programmed data on the application of any one of the eight strobe pulses that relates to the selected power source and function. Table 4-2 provides a listing as to the programmed data, and its routing in relation to the applied strobe pulse.

The Digital Programming logic is reset on the application of the ZERO CLEAR signal from the Digital Input Assembly A8 or internally from when power turn-on operation is initiated.

TABLE 4-2 DIGITAL PROGRAMMED DATA A7 OUTPUT ROUTING

APPLIED STROBE	PROGRAMMED DATA	OUTPUT ROUTING
O.V. STROBE (A)	OVER VOLTAGE (A) 4-BITS	A2 Assembly
O.V. STORBE (B)	OVER VOLTAGE (B) 4-BITS	A1 Assembly
O.I. STORBE (A)	OVER CURRENT (A) 4-BITS	A4 Assembly
O.I. STROBE (B)	OVER CURRENT (B) 4-BITS	A3 Assembly
VOLTAGE STROBE (A)	STROBED DATA AND POSITION (A) 7-BITS	A6 and A9 Assemblies
VOLTAGE STROBE (B)	STROBED DATA AND POSITION (B) 7-BITS	A5 and A9 Assemblies
RNG/POL STROBE (A)	RANGE (A) 2-LINES	A6 Assembly
	POLARITY +/- (A) 1-LINE	A2 Assembly
RNG/POL STROBE (B)	RANGE (B) 2-LINES	A5 Assembly
	POLARITY +/- (B) 1-LINE	A1 Assembly

A 10 kHz CLOCK signal is routed from the A7 Assembly to the DAC (A) and DAC (B) Assemblies (A6 and A7). Six signal lines output the polarity and decimal point status to the display circuits located on A9 Assembly from the A7 Assembly.

The two DAC PCB Assemblies A6 and A5 provide the following functions; the convertion of the digital strobed output voltage data to a analog voltage control signal and provides the digital/analog isolation via opto-isolators. The 2-line RANGE (A/B) signals selects either the X1 or X0.1 DAC scale factors. A READY FLAG (A/B) is generated when the DAC has converted the proper voltage control signal and the Power Source output has settled. The READY FLAG is routed to the remote device via the Digital Input Assembly A8 and the Digital Interface Connector J1. The OVER CURRENT lamps DS1 and DS2 are monitored to generate a OVER CURRENT FLAG (A/B) which outputs via opto-isolators to the remote device via the Digital Input Assembly A8 and the Digital Interface Connector J1. The +SENSE (A/B) and the -SENSE (A/B) levels from the Power Source and Over Current Assemblies A3 and A4 are applied to the DAC (A/B) Assemblies to provide a reference of the output voltage sense regulation. The calibration of the DAC (A/B) offset and magnitude is by the ZERO ADJ (A/B) and FULL SCALE ADJ (A/B) potentiometers located on the Control and Display Assembly A9.

The digital +5V (DIG) and +10V (RAW) power supply has its rectifier diodes (CR1 and CR2) mounted on the Main Chassis Assembly, and the +5V (DIG) output is regulated by transistor Q1 and IC voltage regulator U1 which is located on the Right Gusset Heat Sink Assembly. Six seperate analog power supplies provide the +5V, +15V and -15V regulated outputs for the A and B related power source circuits. The diode rectifiers (CR3 through CR14) for these supplies are located on the Digital Mother PCB Assembly. Their associated IC voltage regulators (U2 through U7) are mounted on the Right Gusset Heat Sink Assembly. All the analog power supplies have their returns floated with respect to one another and the digital power supply. A single return tie point for the analog power supplies is the -SENSE (A/B) buss located on the respective DAC (A/B) PCB Assemblies A5 and A6.

4.2.2 Analog Section Functional Description

The Analog Section which is comprised of the Analog Mother PCB and its four plug-in PCB's A1 through A4 provide for the two power sources and their over voltage, over current and polarity reversal functions.

The two Power Source and Over Current PCB Assemblies A4 and A3 are Regulated variable output 0-50 Volt 1 ampere Power Supplies. The VOLTAGE CONTROL (A/B) signal from the DAC (A/B) Assemblies sets the output voltage. The OVER CURRENT (A/B) 4-bit BCD code from the Digital Programming PCB Assembly sets the over current limit level of the supplies. Two series regulators and one shunt regulator control each of the Power Sources outputs and are located on the Left Gusset Heat Sink Assembly. Listed below are the regulator transistors located on the heat sink and their related functions.

1. Q4 Power Source (A) shunt regulator
2. Q2 and Q3 Power Source (A) series regulators
3. Q7 Power Source (B) shunt regulator
4. Q6 and Q7 Power Source (B) series regulators

The front panel Volt Meter M1 measures the sense voltage of the A or B power source and is connected across the A or B -SENSE and +SENSE lines via the A-METER SOURCE-B switch P/O S1. The Ampere Meter M2 is shunted across an 1 ohm 3 watt resistor R6 which is in series with the -VOLTAGE output on the A2 and A1 Assemblies. A current meter calibration potentiometer R12 located on the A2 and A1 Assemblies provide for the calibration of the ampere meter circuit of each Power Source. The A-METER SOURCE-B switch P/O of S1 provides the switching of the ampere meter to the A or B Power Source ampere meter circuits.

The Sign and Over Voltage PCB Assemblies A2 and A1 provides for the over voltage circuit trip level and the polarity reversal of the Power Sources. The OVER VOLTAGE (A/B) 4-BIT BCD is applied from the Digital Programming PCB Assembly A7 to enter the over voltage trip level, when the voltage across the -SENSE and + SENSE lines exceed the programmed over voltage level the O.V. (A/B) signal will gate on the A or B over voltage SCR (CR16 or CR17) to effect a short across the -VOLTAGE and +VOLTAGE (A/B) lines, thus pulling the power source output down to zero volts. The over voltage circuit once tripped, will remain latched until the output voltage is re-programmed to zero volts or an power off-on cycle is effected. Polarity reversal is performed by four transistors configured as a polarity bridge converter circuit connected between the ±VOLTAGE outputs of the Power Source and the voltage output rear panel terminal strips. When the POLARITY +/- (A/B) signal is placed low, the alternate pair of transistors are enabled, thus providing a reversal of the output polarity. The sense polarity is also reversed via relay switching.

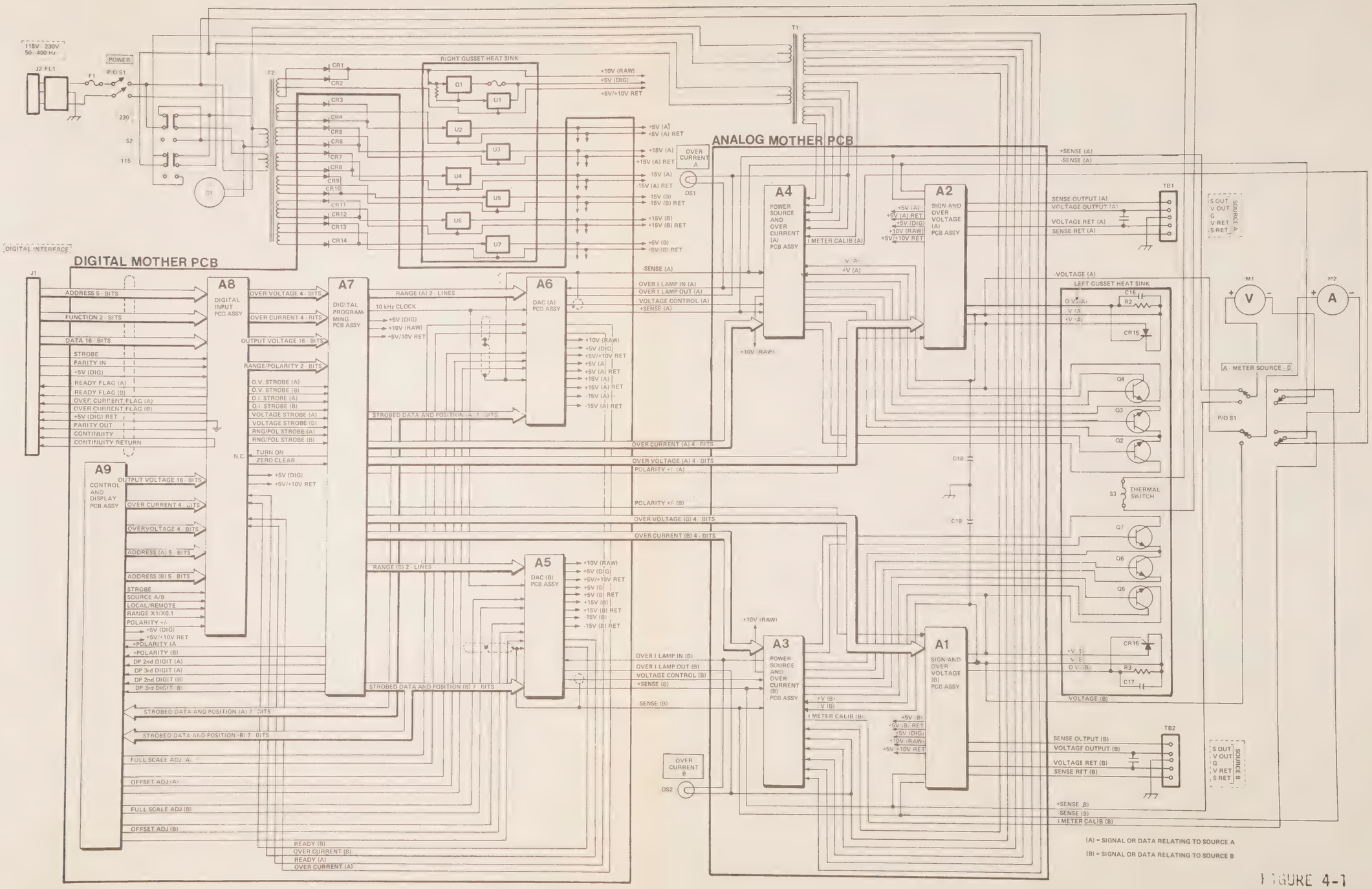

FIGURE 4-1
MODEL DPSD-50
FUNCTIONAL BLOCK DIAGRAM

4.3 DETAILED CIRCUIT DESCRIPTIONS

The following detailed circuit descriptions are referenced to functional logic diagrams located within this chapter and to the schematic diagrams located in Chapter 6 of this manual.

4.3.1 Control and Display PCB Assembly A9

The Control and Display Assembly plugs into the Digital Mother PCB and interfaces with Assemblies A5,A6,A7 and A8. The Control and Display Assembly provides two basic functions; local control of the dual power sources and the visual display of the programmed voltage of each of the power sources.

The switch panel which is accessed via a hinged front panel door contains the digital BCD rocker switches, that are used to program the output voltage, over voltage and over current values. Two sets of binary 1-2-4-8-16 switches are also provided for address selection on the A and B sources. Slide switches are provided for the range, polarity, source, and local/remote mode and function selections. A push-button switch is provided for the generation of the manual (local) strobe which allows entry of the manual programmed data into the memory. All of the programming, mode and function switches interface via the Digital Mother PCB with the Digital Input PCB Assembly A8. Four potentiometers provide for front panel access adjustment of the A and B DAC's offset and full scale calibration. These potentiometers interface via the Digital Mother Board with the Digital to Analog PCB Assemblies A5 and A6.

The visual display consists of two 4-digit seven segment LED display elements and two LED sign legend (+ or -) elements, which is a seperate sub-assembly that plugs into the A9 Assembly. The STROBED BCD data containing the programmed output voltage values generated by the Digital Programming PCB Assembly A7 is applied to the integrated circuit U1, which is a BCD to Seven Segment Decoder/Driver (74247). Its seven line output is applied in parallel via pull up resistors R1 through R7 to the cathodes of the LED seven segment digit indicators (DS2 through DS5 and DS7 through DS10). The digit position data in the 1-2-4 BCD format which is also generated by Assembly A7 is applied to integrated circuit U2, a BCD to Decimal Decoder (74145), which decodes the position data to a one-of-eight line format. Integrated circuit U2 outputs via driver transistors Q1 through Q8 to the anodes of the 8 seven segment LED indicators. The decimal point (DP) LED's contained within the digit display elements are illuminated by the decimal point data from Assembly A7, thus providing decimal point location (tens or units) on the programmed volts A and B display. The sign legend display elements (DS1 and DS6) are wired so that their C segments (-) are illuminated at all times (pin 8 returned to ground). When pin 7 is set low via the ±A and/or ±B lines the D segment will illuminate to display a + legend.

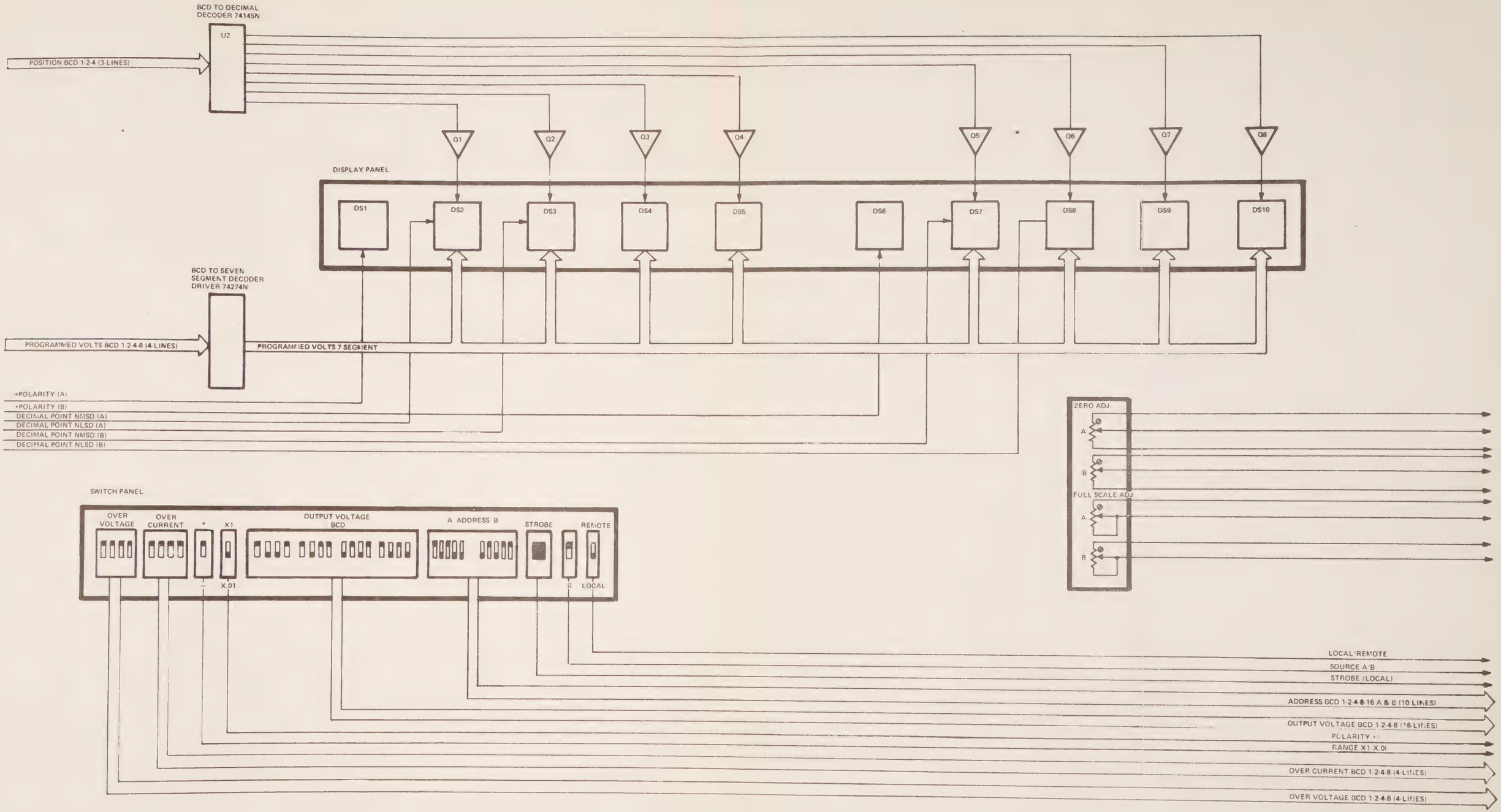

FIGURE 4-2
A9 CONTROL & DISPLAY PCB ASSEMBLY
FUNCTIONAL LOGIC DIAGRAM

4.3.2 Digital Input PCB Assembly A8

The Digital Input PCB Assembly receives its inputs from the Control and Display PCB Assembly and the rear panel remote Digital Interface Connector J1. Its basic function is the selection (remote or local) of the programming data and the generation of the programming strobes which are applied to the Digital Programming PCB Assembly A7.

The digital input selection logic provides operation in either of the local or remote and A or B source modes, as determined by the Control and Display Assembly A9 mode switch settings.

When the local mode is selected PCB pin [20] is set low (digital ground) and the data selectors U16 through U22 are selected for local data transfer by placing their SELECT (pins 1) low, thus, selecting the A inputs (pins 2,5,11 and 14). A logic low (LOCAL) is also placed on gates U28 pin 3, U29 pin 2 and U3 pin 13 to inhibit all remote strobe and remote select functions, and enable the local strobe generation.

Source selection is by the level set on PCB pin [18]. A logic low will select the A SOURCE, and a logic high (pulled up to +5V via 5 k resistor U48A) will select the B SOURCE. Gates U30-11 (A SOURCE) and U30-8 (B SOURCE) allows for the gate enable of either the A or B source strobes.

When the STROBE pushbutton switch is depressed a momentary low is placed on PCB pin [19] as the local strobe, which triggers the one-shot M.V. comprised of three elements of U3, capacitor C2, resistor R2 and diode CR1. When triggered the one-shot M.V. generates a strobe pulse of ≈15 μs duration, which is applied via gates U11-6 and U30-3 to the strobe select logic to allow the output of either the four A source or the four B source strobes. The local one-shot M.V. output (U13-2) is also applied to IC one-shot M.V. U33A which generates a CLEAR-ZERO signal ≈15 ms after the strobe which is applied to PCB pin (18) via gate U49-3 as an output.

When the remote mode is selected PCB pin [20] is set high (pulled up to +5V via 5 k resistor U48B) and the data selectors (U16 through U22) are selected for remote data transfer by placing their SELECT (pins 1) high. Thus selecting the B inputs (pins 3,6,10 and 13). A logic high (REMOTE) is also applied to gates U28 pin 3, U29 pin 2 and U3 pin 13 to inhibit all local strobe functions, and enable the remote strobe and select functions.

The remote data is applied via sixteen "AND" gates (U5 thorugh U8), which function as non-inverting TTL line receivers to the B inputs of the data selectors. Thus allowing transfer of the selected programming data to the Digital Programming PCB Assembly A7 when the remote mode is selected. An even parity bit is applied to PCB pin 27 and buffered by U12-8 then applied to the Parity Generator/Checker input at U15 pin 3. This even parity bit is also inverted by U3-6 and applied as an odd parity bit to pin 4 of U15. U15 is cascaded by U16 to allow a bit for bit parity check of each remote data input line (16 bits). An even parity output bit from U16 pin 5 is buffered by U1-4 and applied to PCB pin 32 as the PARITY OUT signal.

The 5-bit remote address is applied via five "NAND" gates (U2 and U3A) which function as inverting TTL line receivers. This 5-bit address is then applied to the source A and source B address select logic exclusive "OR" gates as a true logic high. The address switch inputs from the A9 Assembly is applied directly to the

other exclusive "OR" gate inputs as a true logic low. When the remote address format complements the address switch format the appropriate exclusive "OR" gates are enabled. A strobe enable is generated on a address select match by gates U28,U29 and U3-8 and applied to the B input of the remote strobe one-shot M.V. U23-B pin 10. "NAND" gate U29 will output a logic low when an A source address is decoded on a logic high when an B source address is decoded.

The external strobe pulse input at PCB pin 25 is applied to "NAND" gate U12-6 which functions as a inverting TTL line receiver and feeds U3-6. The circuit comprising of U3-6, R4 and C4, provides pulse duration detection, which prevents the one-shot M.V. U23B from being triggered by spikes or "gliches" that are less then 10 µs in duration. The external strobe one-shot M.V. U23B is negative edge triggered by the strobe pulse applied to its A input, when an enabling logic high is set on its B input by the address decode logic (U9 pin 8 output). When triggered, U23's Q output (pin 5) generates a pulse of ≈15 µs duration which is inverted and enabled by "NAND" gate U3-11 and applied to U24 pin 12 as the external strobe enable pulse.

Integrated circuit U24 is a 7442 BCD-to-Decimal Decoder which provides the external strobe generation functions. Its output strobe (one-of-eight) is selected by the configuration on its A,B and C inputs (pins 15,14 and 13), when the D input (pin 12) is pulsed low. The external (remote) 2-bit function address is applied to PCB pins 23 and 22 and applied to U24's A and B inputs via "AND" gates U12-11 and U12-3 which function as TTL line receivers. U24's C input (pin 13) is the source select (source A = logic low and source B = logic high). Table 4-3 provides a truth table of U24's strobe generation logic.

TABLE 4-3 STROBE GENERATION TRUTH TABLE

U24 BCD INPUTS A	B	C	D	U24 OUTPUT PIN NUMBER	FUNCTION
0	0	0	0	1	Output Voltage (A) Strobe
1	0	0	0	2	Over Voltage (A) Strobe
0	1	0	0	3	Over Current (A) Strobe
1	1	0	0	4	Range/Polarity (A) Strobe
0	0	1	0	5	Output Voltage (B) Strobe
1	0	1	0	6	Over Voltage (B) Strobe
0	1	1	0	7	Over Current (B) Strobe
1	1	1	0	9	Range/Polarity (B) Strobe

Two status flags; Over Current and Ready from each DAC PCB Assembly are applied to output buffers U1-8, U1-12, U1-10 and U1-2 and output to the remote device via the Digital Interface Connector J1. The READY A or READY B FLAG's indicate that when an Output Voltage change has been effected the DAC error amplifier has settled to its new value. The Over Current A/B Flags indicates that A or B source front panel OVER CURRENT indicator lamp is illuminated and a over current condition is present.

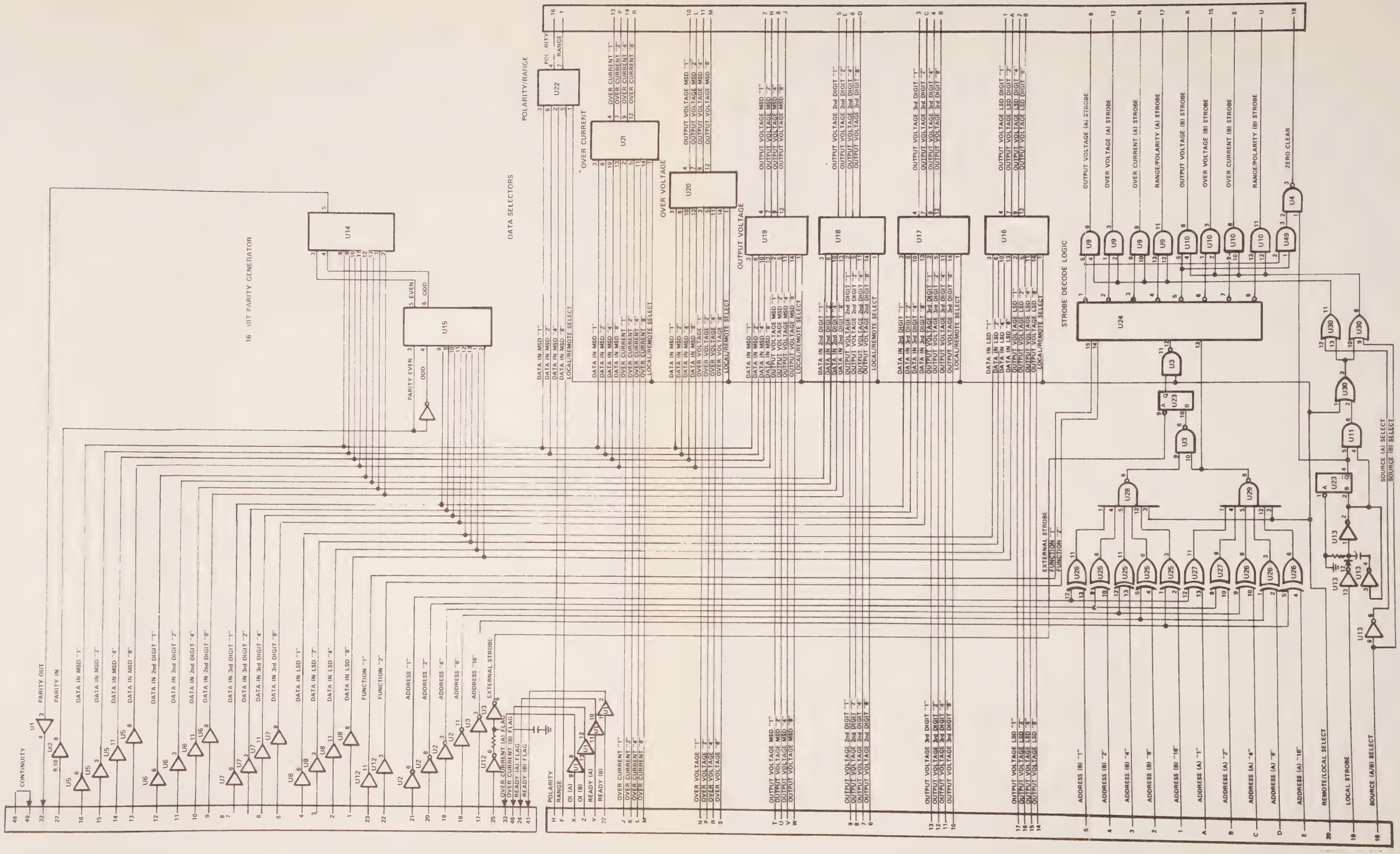

FIGURE 4-3
A8 DIGITAL INPUT PCB ASSEMBLY
FUNCTIONAL LOGIC DIAGRAM

4.3.3 Digital Programming PCB Assembly A7

The Digital Programming PCB Assembly receives the selected Output Voltage, Over Voltage, Over Current, Polarity and Range values in BCD format, along with the enabling strobes from the Digital Input PCB Assembly A8. Table 4-4 details the input A8 to A7 interface as to function and PCB pinning information.

TABLE 4-4 DIGITAL PROGRAMMING ASSEMBLY (A7) INPUT INTERFACE

PCB A7/ A8 PIN NO.	FUNCTION
7	Output Voltage MSD Bit "1"
H	Output Voltage MSD Bit "2"
B	Output Voltage MSD Bit "4"
J	Output Voltage MSD Bit "8"
5	Output Voltage NMSD Bit "1"
E	Output Voltage NMSD Bit "2"
6	Output Voltage NMSD Bit "4"
7	Output Voltage NMSD Bit "8"
3	Output Voltage NLSD Bit "1"
C	Output Voltage NLSD Bit "2"
4	Output Voltage NLSD Bit "4"
D	Output Voltage NLSD Bit "8"
1	Output Voltage LSD Bit "1"
A	Output Voltage LSD Bit "2"
2	Output Voltage LSD Bit "4"
B	Output Voltage LSD Bit "8"
10	Over Voltage Bit "1"
L	Over Voltage Bit "2"
11	Over Voltage Bit "4"
M	Over Voltage Bit "8"
13	Over Current Bit "1"
P	Over Current Bit "2"
14	Over Current Bit "4"
R	Over Current Bit "8"
T	Range/Polarity Bit "1"
16	Range/Polarity Bit "2"
9	Output Voltage Strobe (A)
12	Over Voltage Strobe (A)
N	Over Current Strobe (A)
17	Range/Polarity Strobe (A)
K	Output Voltage Strobe (B)
15	Over Voltage Strobe (B)
S	Over Current Strobe (B)
U	Range/Polarity Strobe (B)
18	Zero Clear
V	Turn On (To A8 used with IEEE-488 Interface Only)

The selected input BCD data is applied to fourteen 4-bit Storage Registers IC's (U7 through U20). Parallel entry is made on a logic low "0" strobe at pin 1 which will transfer the data to the associated outputs (pins 5,9,2 and 12). The 32-bit

OUTPUT VOLTAGE data from U7 through U11 is applied to the four 8-bit multiplexers U3 through U6. Integrated circuit U1 is a type 555 timer which is configured as a 10 kHz free-running M.V. having a 20% duty cycle which clocks Binary Counter U2. IC U2 a 8281 Clocks on the negative (falling) edge of the 10 kHz clock and outputs a 1-2-4 strobed address to the Multiplexers. The Multiplexers (U3 through U6) outputs at their pins 5 a strobed BCD 1-2-4-8 Programmed Output Voltage data.

The Output Voltage 32-bit Storage Register U7 through U14 are reset to zero on the application of logic low to their pins 13 when a RESET A or RESET B is generated by the RESET LOGIC. The RESET A or RESET B signals are generated on a power on operation, a ZERO CLEAR reset applied to PCB pin 18 or on a range/polarity change of the effected source (A or B).

The Digital Programming Assembly outputs Programmed Data, Commands, Decimal and Position Location Data to all the other PCB assemblies of the DPSD-50. Table 4-5 details the output interface as to function and PCB pinning information.

TABLE 4-5 DIGITAL PROGRAMMING ASSEMBLY (A7) OUTPUT INTERFACE

A7 OUTPUT PCB PIN NO.	FUNCTION	TO ASSY (S)- PIN NO.
6	10 kHz Clock	A5/A6-6
M	Programmed Output Voltage Data Bit "1"	A5/A6-11,M A9-D
P	Programmed Output Voltage Data Bit "2"	A5/A6-13,P A9-C
H	Programmed Output Voltage Data Bit "4"	A5/A6-7,H A9-F
K	Programmed Output Voltage Data Bit "8"	A5/A6-9,K A9-E
N	Position (Address) Data Bit "1"	A5/A6-12,N A9-3
L	Position (Address) Data Bit "2"	A5/A6-10,L A9-4
8	Position (Address) Data Bit "4"	A9-5
J	Position (Address) Data Bit "8"	A5/A6-8,J
D	+ Polarity (A)	A9-K
C	+ Polarity (B)	A9-L
F	Decimal Point NMSD (A)	A9-H
E	Decimal Point NLSD (A)	A9-J
2	Decimal Point NMSD (B)	A9-X
B	Decimal Point NLSD (B)	A9-W
15	Over Voltage (A) Data Bit "1"	A2-3
16	Over Voltage (A) Data Bit "2"	A2-A
17	Over Voltage (A) Data Bit "4"	A2-2
18	Over Voltage (A) Data Bit "8"	A2-1
V	Over Current (A) Data Bit "1"	A4-Y
T	Over Current (A) Data Bit "2"	A4-Z
U	Over Current (A) Data Bit "4"	A4-X
S	Over Current (A) Data Bit "8"	A4-T
R	Polarity Change (A)	A2-14,R
W	Range Relay (A) K1	A6- 20 , X
X	Range Relay (A) K2	A6- 19 , W
19	Over Voltage (B) Data Bit "1"	A1-3
20	Over Voltage (B) Data Bit "2"	A1-A
21	Over Voltage (B) Data Bit "4"	A1-2
22	Over Voltage (B) Data Bit "8"	A1-1

TABLE 4-5 DIGITAL PROGRAMMING ASSEMBLY (A7) OUTPUT INTERFACE (Cont'd)

A7 OUTPUT PCB PIN NO.	FUNCTION	TO ASSY (S)- PIN NO.
Z	Over Current (B) Data Bit "1"	A3-Y
X	Over Current (B) Data Bit "2"	A3-Z
Y	Over Current (B) Data Bit "4"	A3-X
W	Over Current (B) Data Bit "8"	A3-T
14	Polarity Change (B)	A1-14,R
20	Range Relay (B) K1	A5- 20 , X
19	Range Relay (B) K2	A5- 19 , W
V	Turn On (Reset) (Used on IEEE-488 Interface Only)	A8-V

4.3.4 Digital to Analog A/B PCB Assemblies A5 & A6

The DPSD-50 has two Digital to Analog (DAC) PCB's installed on its Digital Mother PCB Assembly. Assembly A5 controls the B source and Assembly A6 controls the A source.

The basic function of the DAC PCB Assemblies is to convert the programmed digital BCD output voltage code to an analog voltage control signal. The DAC Assemblies also provide for the isolation between the Power Source's digital and analog functions by the use of the "Opto-isolator" (LED/phototransistor) devices in the case of the 16-bit BCD programmed output voltage data (digital to analog), and the READY FLAG and the OVER CURRENT FLAG (analog to digital). Two relays provide the digital to analog range change function isolation.

The digital interface of the DAC A5 and A6 Assemblies is with the Digital Programming PCB Assembly A7 and the Digital Input PCB Assembly A8. Table 4-6 details the A7/A8 to A5/A6 digital interface as to function and PCB pinning information.

TABLE 4-6 DAC PCB ASSEMBLIES A5 & A6 DIGITAL INTERFACE

A5/A6 PIN NO(S)	FUNCTION	A7 or A8 PIN NO(S)
A5/A6-M,W	Programmed Output Voltage Data Bit "1"	A7-M
A5/A6-P,13	Programmed Output Voltage Data Bit "2"	A7-P
A5/A6-H,7	Programmed Output Voltage Data Bit "4"	A7-H
A5/A6-K,9	Programmed Output Voltage Data Bit "8"	A7-K
A5/A6-N,12	Position (Address) Bit "1"	A7-N
A5/A6-L,10	Position (Address) Bit "2"	A7-L
A5/A6-J,8	Position (Address) Bit "4"	A7-8
A5/A6-6	10 kHz Clock	A7-6
A6-V,18	Ready Flag (A)	A8-Y
A6-U,17	Over Current Flag (A)	A8-X
A5-V,18	Ready Flag (B)	A8-22
A5-U,17	Over Current Flag (B)	A8-Z
A6-X,20	Range Relay K1 (A)	A7-W
A6-W,19	Range Relay K2 (A)	A7-X
A5-X,20	Range Relay K1 (B)	A7-20
A5-W,19	Range Relay K2 (B)	A7-19

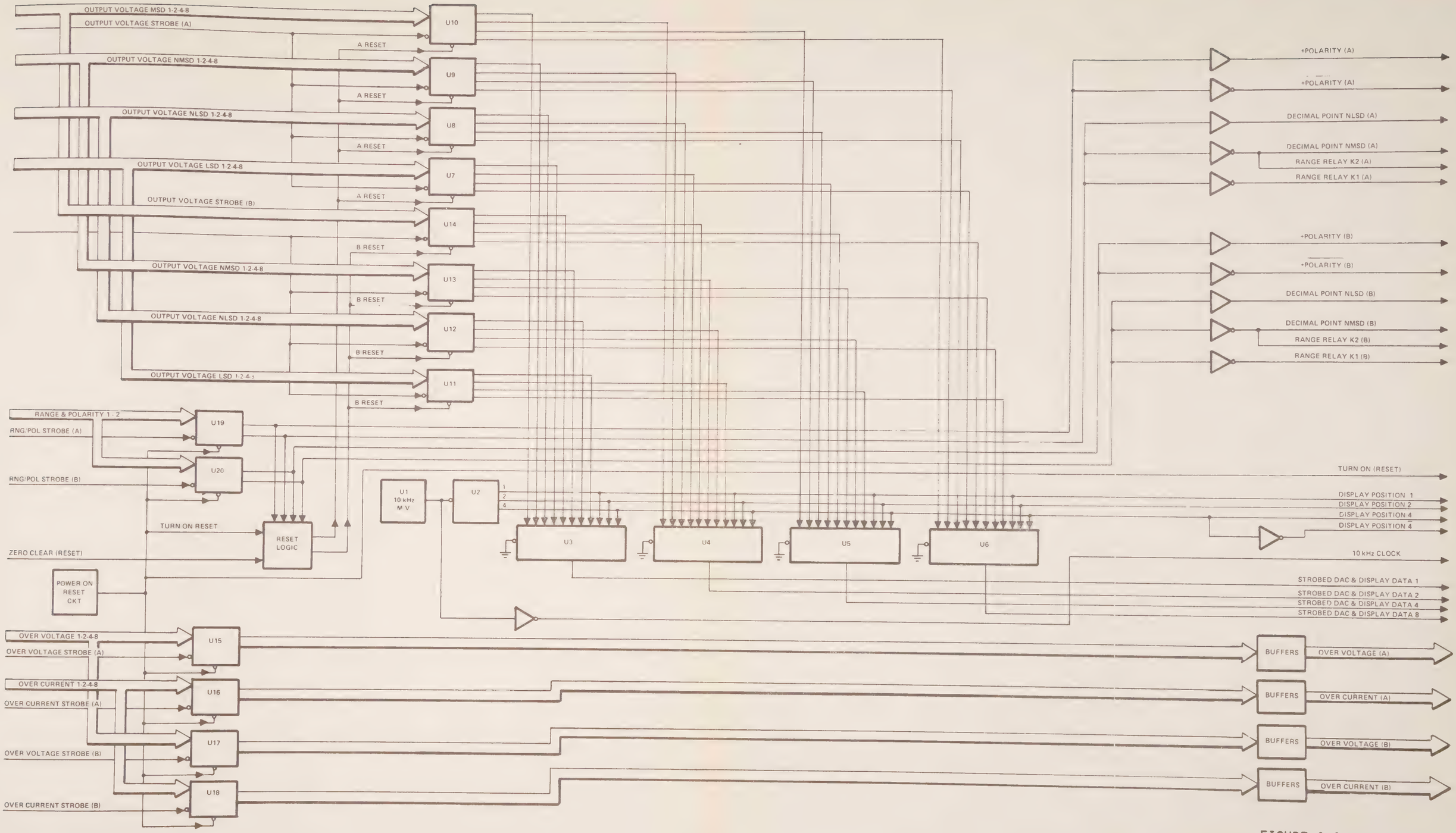

FIGURE 4-4
A7 DIGITAL PROGRAMMING PCB ASSEMBLY
FUNCTIONAL LOGIC DIAGRAM

The analog interface of the DAC A5 and A6 Assemblies is with the A9 Assembly via the Digital Mother PCB, and the A3 and A4 Assemblies via the Digital/Analog Mother PCB interconnect. Table 4-7 details A5/A6 to A9, A3 and A4 analog interface.

TABLE 4-7 DAC PCB ASSEMBLIES ANALOG INTERFACE

A5/A6 PIN NO(S)	FUNCTION	MOTHER PCB'S PAD NO.	ASSEMBLY PIN NO(S)
A6-S	A Offset Adj (-)		A9-7
A6-R	A Offset Adj (+)		A9-9
A6-T	A Offset Adj (Swinger)		A9-8
A6-7	A Full Scale Adj (CW)		A9-14
A6-8	A Full Scale Adj (CCW)		A9-15
A5-S	B Offset Adj (-)		A9-11
A5-R	B Offset Adj (+)		A9-10
A5-T	B Offset Adj (Swinger)		A9-12
A5-7	B Full Scale Adj (CW)		A9-16
A5-8	B Full Scale Adj (CCW)		A9-17
A6-P,13	Voltage Control (A)	60	A4-H,7
A5-P,13	Voltage Control (B)	69	A3-H,7
A6-U,17	+ Sense (A)	54	A4-11,12,M,N
A5-U,17	+ Sense (B)	58	A3-11,12,M,N
A6-10,14,15,16,J,K,L	- Sense (A) and Analog Rtn	53	A4-3,4,D,C
A5-10,14,15,16,J,K,L	- Sense (B) and Analog Rtn	68	A3-3,4,D,C
A5-2B	Over Current Lamp In (A)	52	A4-10,L
A5-1,A	Over Current Lamp Out (A)	51	A4-1,A
A6-2,B	Over Current Lamp In (B)	56	A5-10,L
A6-1,A	Over Current Lamp Out (B)	55	A5-1,A

The Digital Output Voltage Data as a strobed BCD 1-2-4-8 code is applied to the four 4-bit Latches (U2 through U5). The Position (Address) Data is applied to the BCD-to-Decimal Decoder (U1) as a 1-2-$\overline{4}$ and 10 kHz CLOCK format. U1 decodes the position Data to four decade enables, which enables Latches U2 through U5, which allows the valid output decoding of the 16-bit BCD output voltage code is then applied to the DAC IC (U22) via sixteen "Opto-Isolator" IC's (U6 through U21).

The DAC converts the 16-bit digital input to a 0 to 10 volt analog level at U22 pin 20. The DAC's internal 6.2 V reference source output at U22 pin 26 (REF OUT) is routed to a front panel potentiometer (FULL SCALE ADJ) which returns to the DAC's U22 pin 27 (REF IN) to adjust the gain of the DAC's internal reference amplifier, allowing adjustment to compensate for any long term drift. U22 pin 24 (CURRENT OUTPUT) is jumpered to U22 pin 22 (+ INPUT) and connected to the swinger of the front panel ZERO ADJ potentiometer, to allow offset (zero) adjustment of the DAC's output to compensate for long term drift. U22 pin 23 (R1) and U22 pin 19 (GND) are connected to the - SENSE AND ANALOG RTN line, thus referencing the DAC zero voltage level to the - SENSE of the power source.

The circuit comprising of U23, Q1, K1 and their associated components is a amplifier having a unity (X1) or X10 voltage gain and provides the source reference voltage output at A5/A6 PCB pins 13 and P. When relay K1 is energized, resistor R46 and

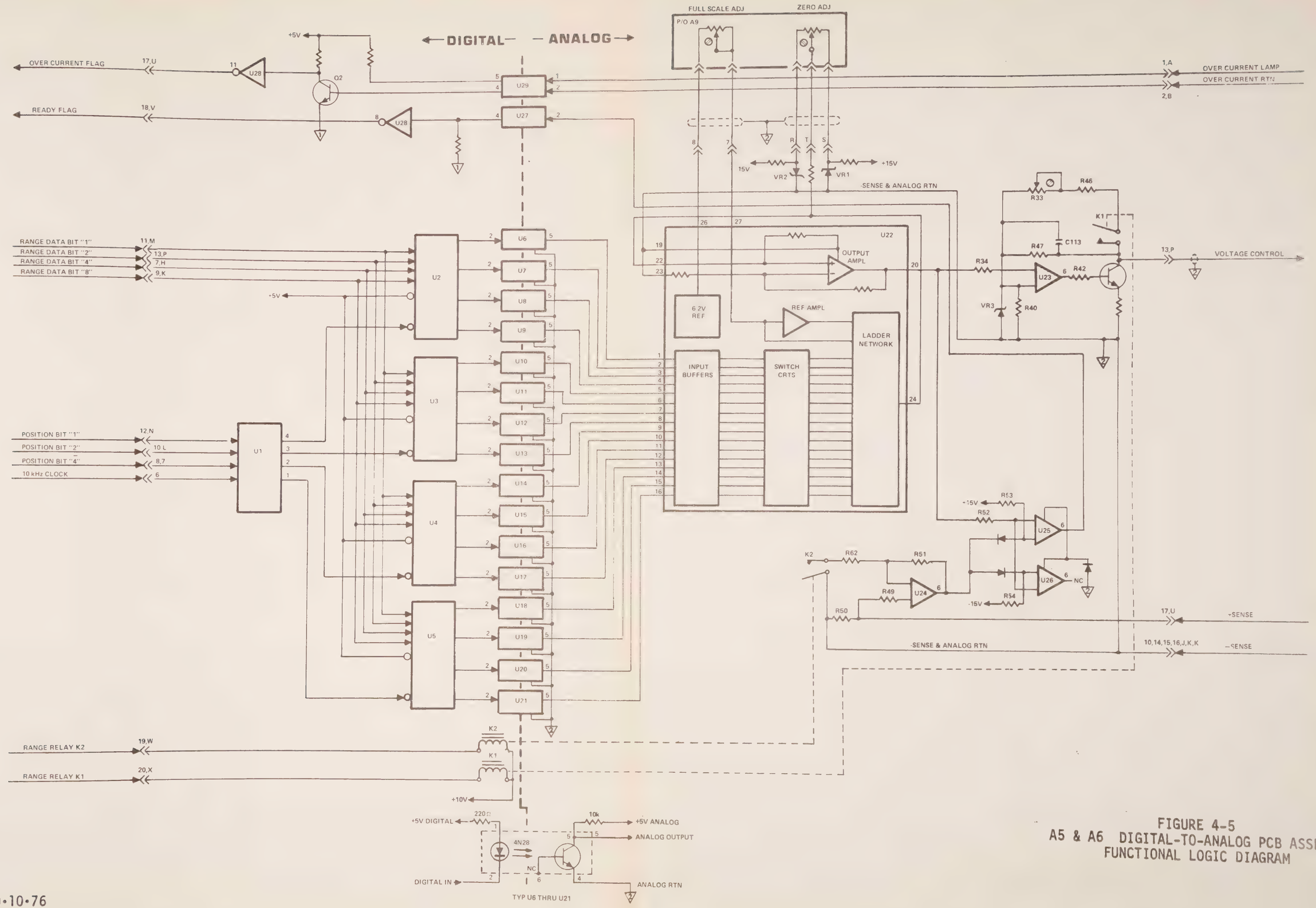

FIGURE 4-5
A5 & A6 DIGITAL-TO-ANALOG PCB ASSEMBLY
FUNCTIONAL LOGIC DIAGRAM

potentiometer R33 are shunted across feed back resistor R47, thus changing the voltage gain of the amplifier circuit from unity (X1) to X10 allowing for the range change from X0.1 to X1.0.

U24, Relay K2 and associated circuit components comprise a unity (X1) or X10 voltage gain amplifier for the + SENSE level applied to A5/A6 PCB pins 17 and U. When the relay K2 is energized the amplifier circuit is set at unity (X1) voltage gain (X0.1 range). The circuit consisting of U25, U26 and their associated components comprise a voltage window detector which compares the + SENSE level with the DAC output level and will generate a $\overline{\text{READY}}$ when they have settled to within 0.7 volts (7.0 volts in the X1.0 range) of each other, thus indicating that the power source has settled to its proper level after a output voltage change. The $\overline{\text{READY}}$ output at U25 pin 6 is applied to Opto-Isolator U27 pin 2. U27's digital output at pin 4 is applied to U28-8 which inverts the signal to a READY FLAG, which is then routed to Assembly A8 via A5/A6 PCB pins 18 and V.

The front panel OVER CURRENT lamps are in series with the analog inputs pins 1 and 2 of Opto-Isolator IC U29. U29 output pin 4 is applied to the driver circuit consisting of Q2 and U28-11 which will generate the OVER CURRENT FLAG drive to Assembly A8 via A5/A6 PCB pins 17 and U.

4.3.5 Power Amplifier and Over Current A/B Assemblies A3 & A4

The Power Amplifier and Over Current PCB Amplifiers A3 and A4 contain the voltage controlled 0 to 50 volt, 1 ampere regulated power supplies and current limiting circuitry for the A and B sources.

The 0 to 50 volt source output power supply circuit consists of bridge rectifier CR1 through CR4, rectifier CR5, two left gusset heat sink mounted series pass regulators transistors (Q2 and Q3 for the A source and Q6 and Q7 for the B source) and a left gusset heat sink mounted shunt regulator (Q4 for the A source and Q5 for the B source). A regulated reference supply provides a +15 volts referenced to the + SENSE line. This + SENSE +15 volt reference supply consists of fullwave rectifier CR13 and CR14, constant current source FET Q6, series regulator Q7 and regulator amplifier U2. Its + SENSE +15 volt output is applied to the V+ (pin 7) of amplifiers U1, 22 and U3. The V- (pin 4) of amplifiers U1 and U3 are connected to the + VOLTAGE -10 reference line (zener VR7). The pre-regulator amplifier U2 has its V- (pin 4) connected to the + SENSE line.

Amplifier U1 controls the output voltage of the source output supply and provides voltage regulation for load and source changes to keep the source output voltage within ±500 microvolts of its programmed level. A 0 to 50 volt analog VOLTAGE CONTROL signal from the DAC PCB Assembly A4 or A5 is applied to the non-inverting input of U1 at its pin 3 via PCB pins [7] and [H]. The inverted input of U1 at pin 2 is referenced to the + SENSE voltage via resistor R16. U1's output at pin 6 controls the left gusset mounted series regulator Q3 or Q6 via the series regulator driver Q3 located on the PCB. U1 pin 6 is also applied to the shunt regulator driver circuit comprised of Q4 and Q5, which controls the left gusset mounted shunt regulator transistor Q4 or Q5.

The circuit comprised of fullwave rectifier CR20 and CR21, FET Q10, capacitor C28 and resistors R52 and R53 prevents overshot of the source output voltage during turn off. When the ac voltage is removed from diodes CR20 and CR21, FET Q10 will gate on to provide a fast response in applying the + VOLTAGE -10 volts to pin 8 of U3, thus pulling down the source output voltage.

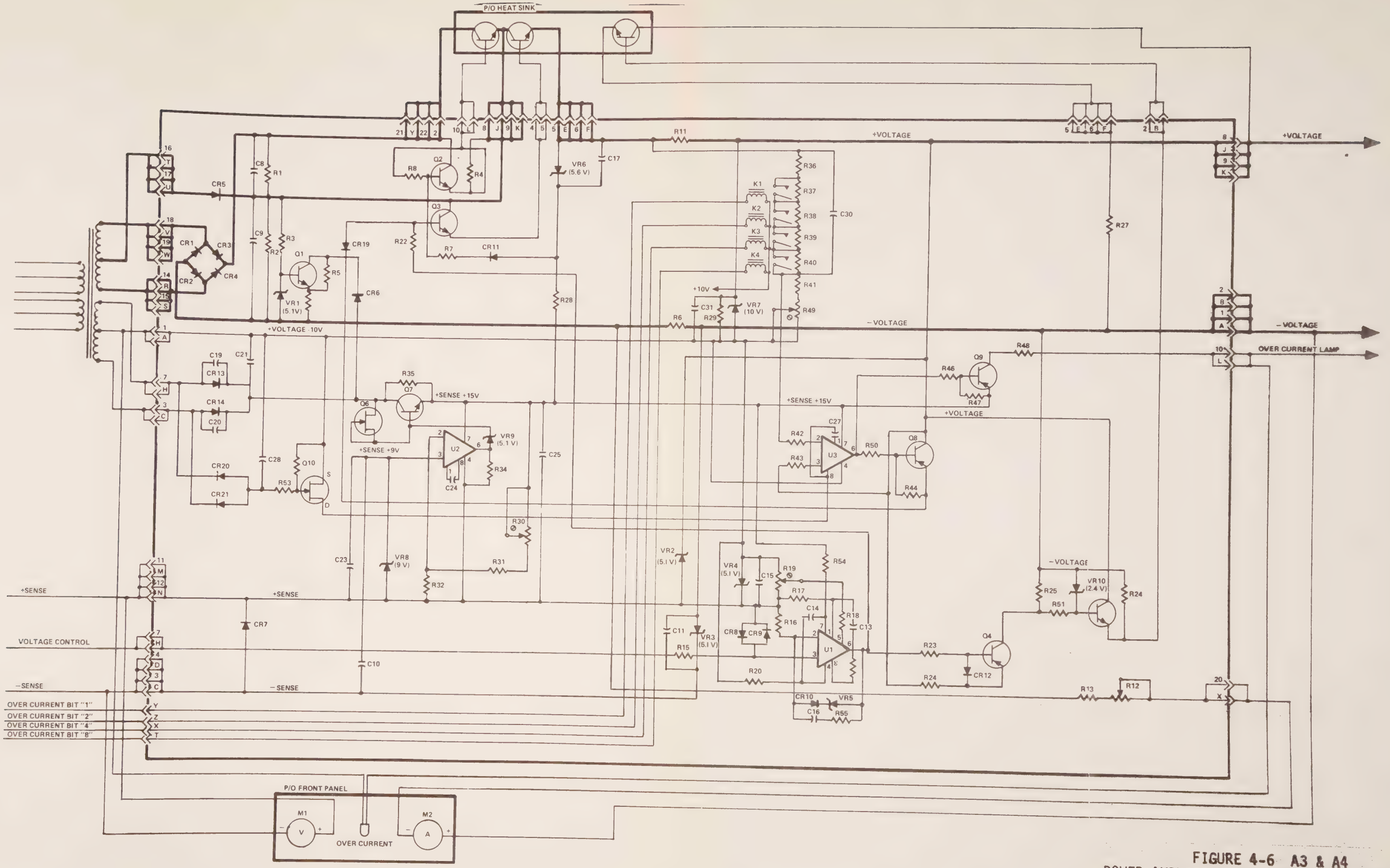

FIGURE 4-6 A3 & A4
POWER AMPLIFIER & OVERCURRENT PCB ASSEMBLY
FUNCTIONAL DIAGRAM

The current limiting of the source output is programmed by the OVER CURRENT 1-2-4-8 BCD code from Assembly A7, which is applied via PCB pins [Y], [Z], [X], and [T]. Relays K1 through K4 select the BCD weighted resistors R37 through R40 to place a voltage level on the non-inverting input (pin 2) of U3 which relates to the programmed over current digital BCD code. The inverting input (pin 3) of U3 is connected to the +VOLTAGE source output line and effectively monitors the IR drop across the 1 ohm series resistor R11. When the voltage level on pin 3 of U3 exceeds the voltage level on pin 2 of U3 an output level at pin 6 which is proportional to the input differential is developed. This U3 pin 6 output is applied via emitter follower Q8 as a current limiting control signal to the series regulator driver amplifier Q3. U3 pin 6 is also applied to transistor Q9 which provides the drive to illuminate the OVER CURRENT lamp via PCB pins [10] and [L].

4.3.6 Sign and Over Voltage PCB Assemblies A1 & A2

Two Sign and Over Voltage PCB plug-in assemblies are installed in the DPSD-50 Analog Mother PCB. Assembly A2 supports the A Source Output and Assembly A1 supports the B Source Output. Each of the Sign and Over Voltage Assemblies provides two basic functions; reversal of the source output polarity and over voltage protection.

A polarity command (SIGN INPUT) signal from the Digital Programming PCB Assembly A7 is applied to PCB pins [R] and [14], when it is set to a logic high (+5V) it will configure the source output for a positive voltage and when set to a logic low (0V, Digital Rtn) it will reverse the source output for a negative output. When the polarity command logic state is changed from a high to a low or from a low to a high one-shot M.V., U4 will trigger and output a 8 ms duration pulse at its Q output (pin 6), which will energize relay K1 via inverter U1-6 and relay driver transistors Q14 and Q15 and effect the opening up of the +SENSE and -SENSE lines for a period of 8 ms. On a polarity change one-shot M.V., U3 will also trigger and generate a 3.5 ms duration pulse which is applied to the A1 input (pin 3) of one-shot M.V., U5. One-shot M.V., U5 triggers on the negative transition and generates a 1 ms duration pulse delayed 3.5 ms from the polarity command transition at its Q output (pin 6). This 1 ms pulse is then applied to the clock input of U2 (pin 13) and will cause U2 to latch up on its D input (pin 3) state. Latch U2's Q output (pin 15) will effect a polarity reversal of the SENSE lines by energizing or de-energizing relay K2 via inverter U1-12 and relay driver transistors Q12 and Q13. Latch U2's $\overline{Q}$ output (pin 14) will effect the polarity reversal of the +VOLTAGE and -VOLTAGE lines. The effectuation of the output voltage polarity reversal is via inverter U1-10 and Opto-Isolator IC U7 to the polarity switching circuit consisting of transistors Q3 through Q10. When positive polarity is selected transistor Q1 and Q3 are switched on and transistor Q7 and Q10 are switched off, thus routing the +VOLTAGE to the V OUT and the -VOLTAGE to the V OUT RTN lines. When negative polarity is selected transistors Q1 and Q3 are switched off and transistors Q7 and Q10 are switched on, thus routing the -VOLTAGE to the V OUT and the +VOLTAGE to the V OUT RTN lines.

The OVER VOLTAGE BCD 1-2-4-8 code from the Digital Programming Assembly A7, is applied to PCB pins [3], [A], [2] and [1], respectively to program relays K3 through K6. These relays provide for the digital to analog isolation of the overvoltage data and configure the BCD weighted resistor ladder consisting of R49 through R52 to the selected overvoltage trip level. The BCD weighted resistor ladder is shunted across the sense lines when the magnitude of the sense voltage exceeds the programmed over voltage trip level operational amplifier U8 will develope a voltage level that will gate on the over voltage SCR (CR15 or CR16) located on the right gusset heat sink, and effect a short across the +VOLTAGE and -VOLTAGE lines. Once tripped, the over voltage SCR will remain on until the output voltage is reprogrammed to 0 volts.

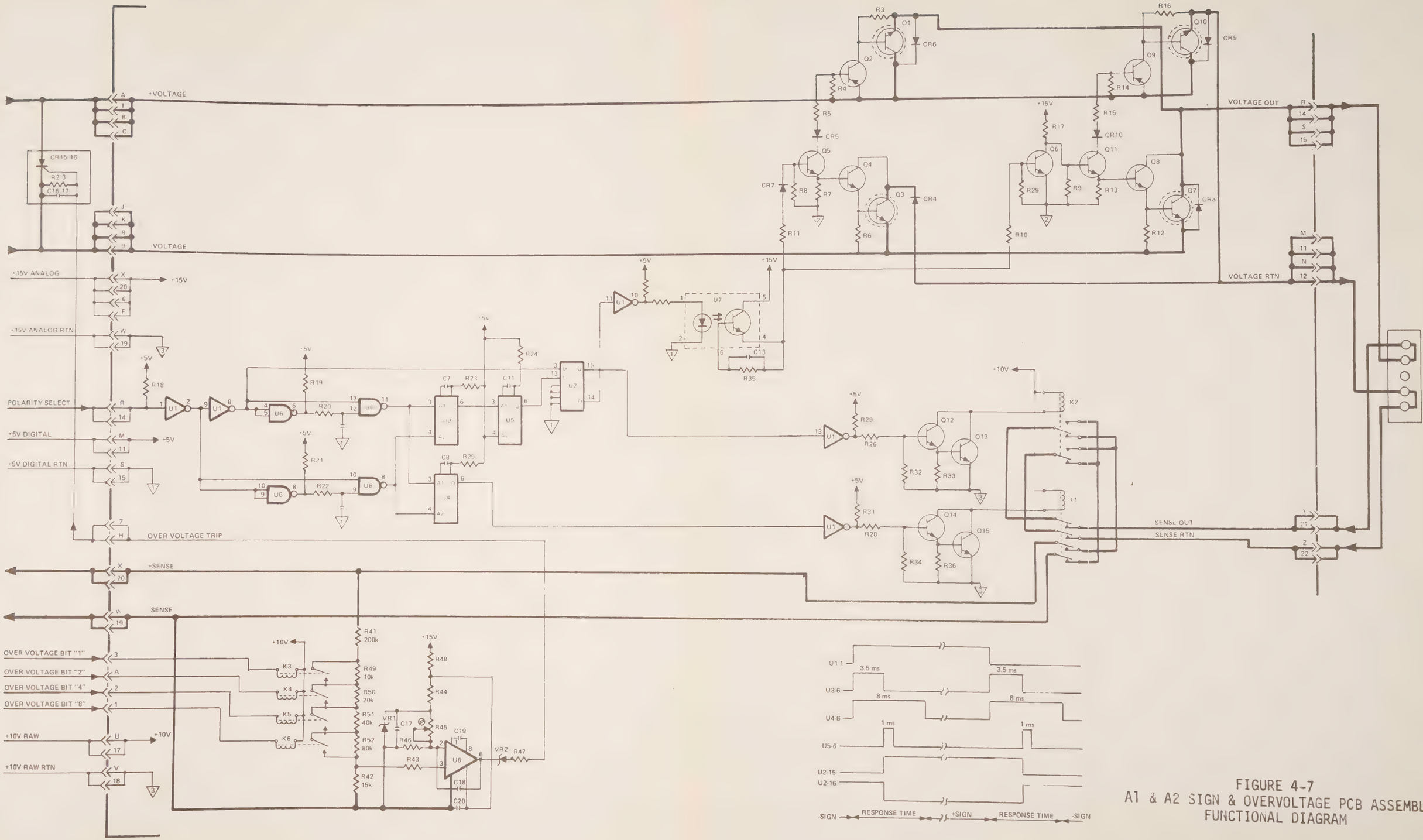

FIGURE 4-7
A1 & A2 SIGN & OVERVOLTAGE PCB ASSEMBLY
FUNCTIONAL DIAGRAM

4.4 INTEGRATED CIRCUIT DATA SHEETS

The following integrated circuit data sheets are provided to give the service technician pinning information, schematic equivalents and detailed characteristics that are unique to the IC device. Table 4-8 provides a listing of the IC data sheets by figure number, device type, description and page number.

TABLE 4-8 INTEGRATED CIRCUIT DATA SHEETS

FIG.NO.	IC TYPE AND DESCRIPTION	PAGE NO.
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4-9	LM301A Operational Amplifier	4-24
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4-28	7442N BCD-to-Decimal Decoder	4-45
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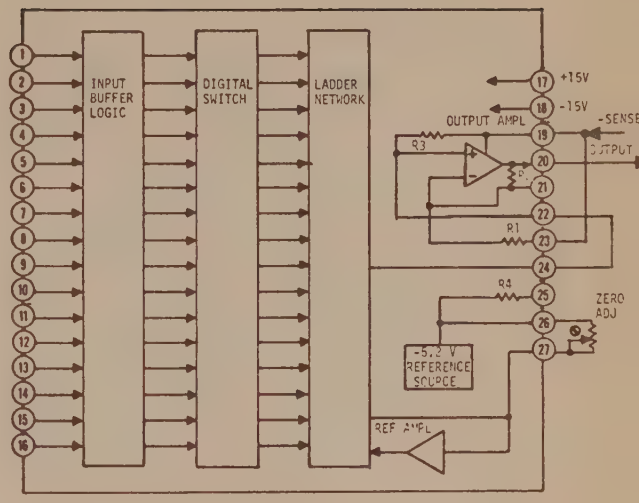
4-33	74151 Data Selector/Multiplexer	4-50
4-34	74157 Quad 2-Line-to-1-Line Selector/Multiplexer	4-51
4-35	74180 9-Bit Odd/Even Parity Generator/Checker	4-52
4-36	74247N BCD-to-Seven-Segment Decoder/Driver	4-53

Output setting time is specified at 750 nanoseconds and 30 microseconds for current and voltage outputs respectively. Output settling time is defined as that time between the application of an input digital word and the output settling to ±0.005% of full scale, and it includes switch delay, nonlinear slewing time and final exponential decay time.

Full scale output ranges have a full scale voltage output of 0 to +10V or 0 to -10V @ 5 mA. The current output can be pin strap strapped for 0 to +1.25 mA full scale.

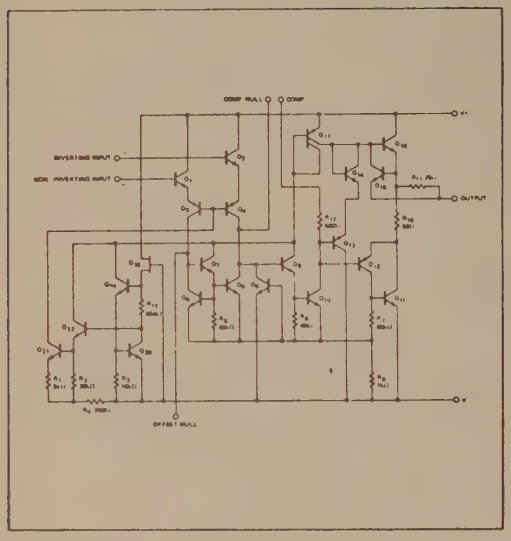
A maximum voltage compliance of 1.0V for full scale current output. All digital inputs are compatible with standard TTL/DTL logic levels. To compensate for long term drifts, offset and gain adjustments are provided.



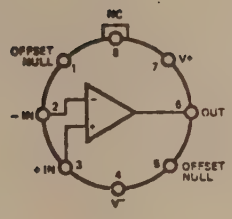
PIN	DAC-169-16V FUNCTION	PIN	DAC-169-16B FUNCTION
1	BIT 1 (MSB)	15	BIT 15
2	BIT 2	16	BIT 16 (LS8)
3	BIT 3	17	+15 Vdc POWER INPUT
4	BIT 4	18	-15 Vdc POWER INPUT
5	BIT 5	19	COMMON GROUND
6	BIT 6	20	VOLTAGE OUTPUT
7	BIT 7	21	-INPUT
8	BIT 8	22	+INPUT
9	BIT 9	23	R1
10	BIT 10	24	CURRENT OUTPUT
11	BIT 11	25	OFFSET (BINARY UNITS ONLY)
12	BIT 12	26	REFERENCE OUT
13	BIT 13	27	REFERENCE IN
14	BIT 14		

FIGURE 4-8, DAC-169-16B, 16-BIT BCD DIGITAL-TO-ANALOG CONVERTER, IC DATA SHEET

EQUIVALENT CIRCUIT



The LM301AH is a general purpose operation amplifier packaged in an 8-lead TO -5 case.

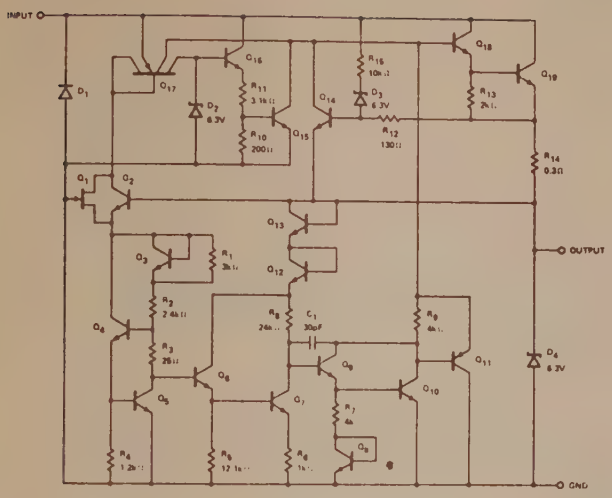


LM301A

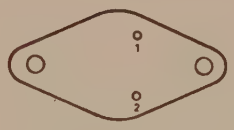
ELECTRICAL CHARACTERISTICS ($0°C \leq T_A \leq 70°C$, $\pm 5V \leq V_S \leq \pm 15V$ and $C_1 = 30pF$ unless otherwise specified.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	$T_A = 25°C$, $R_S \leq 50k\Omega$		2.0	7.5	mV
Input Offset Current	$T_A = 25°C$		3	50	nA
Input Bias Current	$T_A = 25°C$		70	250	nA
Input Resistance	$T_A = 25°C$	0.5	2		MΩ
Supply Current	$T_A = 25°C$, $V_S = \pm 15V$		1.8	3.0	mA
Large Signal Voltage Gain	$T_A = 25°C$, $V_S = \pm 15V$ $V_{OUT} = \pm 10V$; $R_L \geq 2k\Omega$	25	160		V/mV
Input Offset Voltage	$R_S \leq 50k\Omega$			10	mV
Average Temperature Coefficient of Input Offset Voltage			6.0	30	μV/°C
Input Offset Current				70	nA
Average Temperature Coefficient of Input Offset Current	$25°C \leq T_A \leq 70°C$ $0°C \leq T_A \leq 25°C$		0.01 0.02	0.3 0.6	nA/°C nA/°C
Input Bias Current				300	nA
Large Signal Voltage Gain	$V_S = \pm 15V$, $V_{OUT} = \pm 10V$ $R_L \geq 2k\Omega$	15			V/mV
Output Voltage Swing	$V_S = \pm 15V$, $R_L = 10k\Omega$ $R_L = 2k\Omega$	±12 ±10	±14 ±13		V V
Input Voltage Range	$V_S = \pm 15V$	±12			V
Common Mode Rejection Ratio	$R_S \leq 50k\Omega$	70	90		dB
Supply Voltage Rejection Ratio	$R_S \leq 50k\Omega$	70	96		dB

FIGURE 4-9 LM301A, OPERATIONAL AMPLIFIER, IC DATA SHEET



K PACKAGE
(Bottom View)



1. Input
2. Output

Case is connected to ground.

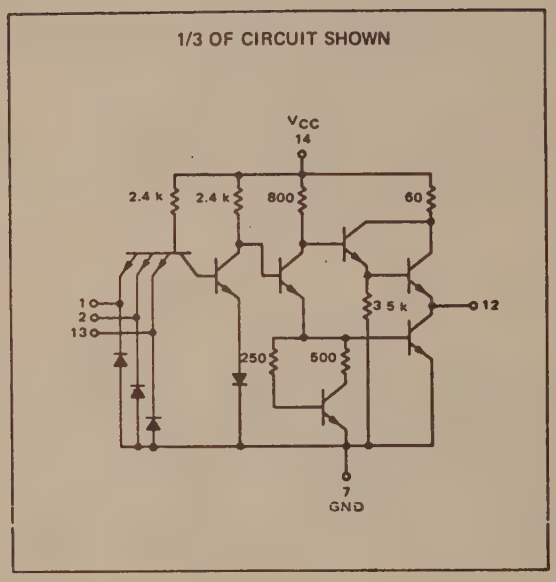
ORDER PART NOS. LM109K/LM209K/LM309K

PARAMETER	CONDITIONS	LM109			LM309			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Output Voltage	$T_j = 25°C$	4.7	5.05	5.3	4.8	5.05	5.2	V
Line Regulation	$T_j = 25°C$							
	$7V \leq V_{IN} \leq 25V$		4	50		4	50	mV
Load Regulation	$T_j = 25°C$							
TO-5	$5mA \leq I_{OUT} \leq 0.5A$		20	50		20	50	mV
TO-3	$5mA \leq I_{OUT} \leq 1.5A$		50	100		50	100	mV
Output Voltage	$7V \leq V_{IN} \leq 25V$							
	$5mA \leq I_{OUT} \leq I_{max}$							
	$P < P_{max}$	4.6		5.4	4.75		5.25	V
Quiescent Current	$7V \leq V_{IN} \leq 25V$		5.2	10		5.2	10	mA
Quiescent Current Change	$7V \leq V_{IN} \leq 25V$			0.5			0.5	mA
	$5mA \leq I_{OUT} \leq I_{max}$			0.8			0.8	mA
Output Noise Voltage	$T_A = 25°C$							
	$10Hz \leq f \leq 100$ kHz		40			40		μV
Long Term Stability				10			20	mV
Thermal Resistance								
Junction to Case (Note 2)								
TO-5			15			15		°C/W
TO-3			3			3		°C/W

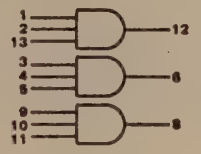
NOTES:

1. Unless otherwise specified, these specifications apply for $-55°C \leq T_j \leq 150°C$ for the 5109 or $0°C \leq T_j \leq 125°C$ for the 5309, $V_{IN} = 10V$ and $I_{OUT} = 0.1A$ for the TO-5 package or $I_{OUT} = 0.5A$ for the TO-3 package. For the TO-5 package, $I_{max} = 0.2A$ and $P_{max} = 2.0W$. For the TO-3 package, $I_{max} = 1.0A$ and $P_{max} = 20W$.
2. Without a heat sink, the thermal resistance of the TO-5 package is about 150°C/W while that of the TO-3 package is approximately 35°C/W. With a heat sink, the effective thermal resistance can only approach the values specified, depending on the efficiency of the sink.

FIGURE 4-10 LM309K, 5 VOLT VOLTAGE REGULATOR, IC DATA SHEET



This device consists of three 3-input AND gates. This non-inverting function is useful for optimizing logic design, or for direct implementation of standard logic equations.

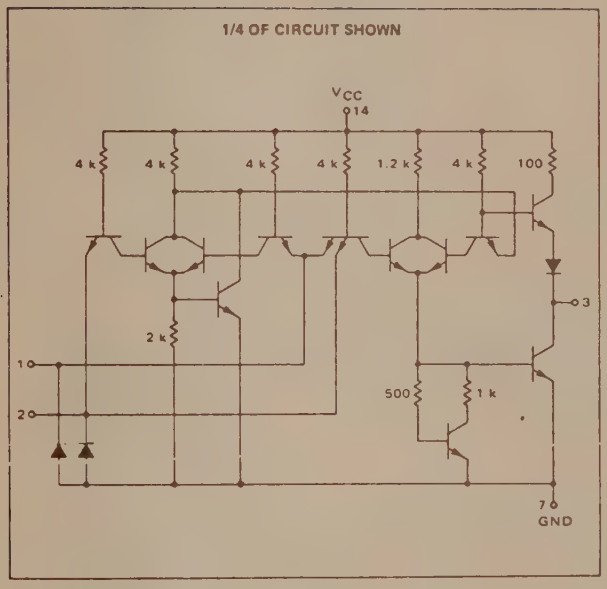


Positive Logic: $12 = 1 \cdot 2 \cdot 13$
Negative Logic: $12 = 1 + 2 + 13$

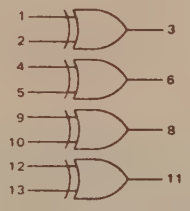
Input Loading Factor = 1
Output Loading Factor = 10

Total Power Dissipation = 84 mW typ/pkg
Propagation Delay Time = 9.0 ns typ

FIGURE 4-11 MC3006, TRIPLE 3-INPUT "AND" GATE, IC DATA SHEET



This device consists of four 2-input Exclusive OR gates. They can be used to build parity checking/generating functions. Up/down counters can be built using these gates and J-K flip-flops.

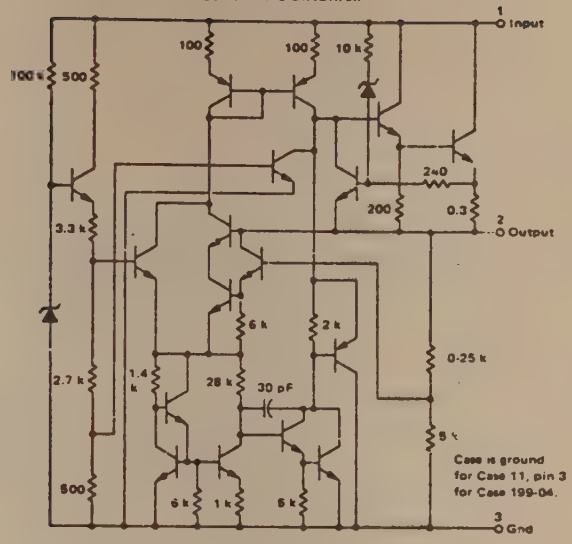


Positive Logic: $3 = 1 \cdot \bar{2} + \bar{1} \cdot 2$

Input Loading Factor = 1.6
Output Loading Factor = 8
Total Power Dissipation = 100 mW typ/pkg
Propagation Delay Time = 14 ns typ

FIGURE 4-12 MC3021, TTL QUAD EXCLUSIVE "OR" GATE, IC DATA SHEET

SCHEMATIC DIAGRAM



D SUFFIX
PLASTIC PACKAGE
CASE 199-04

Pin 1 Input (Base)
Pin 2 Output (Emitter)
Pin 3 Ground (Collector)

Heat sink surface connected to pin 3.

MC7805C ELECTRICAL CHARACTERISTICS (V_{in} = 10 V, I_O = 500 mA, 0°C < T_J < +125°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	4.8	5.0	5.2	Vdc
Input Regulation (T_J = +25°C, I_O = 100 mA) 7.0 Vdc ≤ V_{in} ≤ 25 Vdc 8.0 Vdc ≤ V_{in} ≤ 12 Vdc (T_J = +25°C, I_O = 500 mA) 7.0 Vdc ≤ V_{in} ≤ 25 Vdc 8.0 Vdc ≤ V_{in} ≤ 12 Vdc	Reg_{in}	 – – – –	 7.0 2.0 35 8.0	 50 25 100 50	mV
Load Regulation T_J = +25°C, 5.0 mA ≤ I_O ≤ 1.5 A 250 mA ≤ I_O ≤ 750 mA	Reg_{load}	 – –	 11 4.0	 100 50	mV
Output Voltage (7.0 Vdc ≤ V_{in} ≤ 20 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W)	V_O	4.75	–	5.25	Vdc
Quiescent Current (T_J = +25°C)	I_B	–	4.3	8.0	mA
Quiescent Current Change 7.0 Vdc ≤ V_{in} ≤ 25 Vdc 5.0 mA ≤ I_O ≤ 1.5 A	ΔI_B	 – –	 – –	 1.3 0.5	mA
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	V_N	–	40	–	μV
Long-Term Stability	$\Delta V_O/\Delta t$	–	–	20	mV/1.0 k HRS
Ripple Rejection (I_O = 20 mA, f = 120 Hz)	RR	–	70	–	dB
Input-Output Voltage Differential (I_O = 1.0 A, T_J = +25°C)	$V_{in}-V_O$	 –	 2.0	 –	Vdc
Output Resistance (I_O = 500 mA)	R_O	–	30	–	mΩ
Short-Circuit Current Limit (T_J = +25°C)	I_{SC}	–	750	–	mA
Average Temperature Coefficient of Output Voltage I_O = 5.0 mA, 0°C ≤ T_A ≤ +125°C	TCV_O	 –	 -1.0	 –	mV/°C

The MC7805CP is a three-terminal positive 5 volt, voltage regulator that provides internal thermal overload protection and short circuit output current limiting.

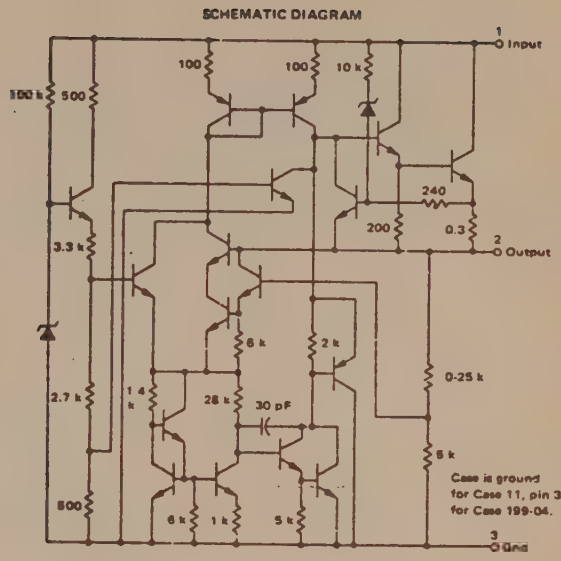
FIGURE 4-13 MC7805CP, +5 VOLT VOLTAGE REGULATOR, IC DATA SHEET

P SUFFIX
PLASTIC PACKAGE
CASE 199-04

Pin 1 Input (Base)
Pin 2 Output (Emitter)
Pin 3 Ground (Collector)

Heat sink surface connected to pin 3.

SCHEMATIC DIAGRAM



MC7815C ELECTRICAL CHARACTERISTICS (V_{in} = 23 V, I_O = 500 mA, 0°C < T_J < +125°C, unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
Output Voltage (T_J = +25°C)	V_O	14.4	15	15.6	Vdc
Input Regulation	Reg_{in}				mV
(T_J = +25°C, I_O = 100 mA)					
17.5 Vdc ≤ V_{in} ≤ 30 Vdc		–	14	150	
20 Vdc ≤ V_{in} ≤ 26 Vdc		–	6.0	75	
(T_J = +25°C, I_O = 500 mA)					
17.5 Vdc ≤ V_{in} ≤ 30 Vdc		–	57	300	
20 Vdc ≤ V_{in} ≤ 26 Vdc		–	27	150	
Load Regulation	Reg_{load}				mV
T_J = +25°C, 5.0 mA ≤ I_O ≤ 1.5 A		–	68	300	
250 mA ≤ I_O ≤ 750 mA		–	25	150	
Output Voltage	V_O				Vdc
(17.5 Vdc ≤ V_{in} ≤ 30 Vdc, 5.0 mA ≤ I_O ≤ 1.0 A, P ≤ 15 W)		14.25	–	15.75	
Quiescent Current (T_J = +25°C)	I_B	–	4.4	8.0	mA
Quiescent Current Change	ΔI_B				mA
17.5 Vdc ≤ V_{in} ≤ 30 Vdc		–	–	1.0	
5.0 mA ≤ I_O ≤ 1.5 A		–	–	0.5	
Output Noise Voltage (T_A = +25°C, 10 Hz ≤ f ≤ 100 kHz)	V_N	–	90	–	μV
Long-Term Stability	$\Delta V_O/\Delta t$	–	–	60	mV/1.0k HRS
Ripple Rejection (I_O = 20 mA, f = 120 Hz)	RR	–	60	–	dB
Input-Output Voltage Differential	$V_{in}-V_O$				Vdc
(I_O = 1.0 A, T_J = +25°C)		–	2.0	–	
Output Resistance (I_O = 500 mA)	R_O	–	95	–	mΩ
Short-Circuit Current Limit (T_J = +25°C)	I_{SC}	–	230	–	mA
Average Temperature Coefficient of Output Voltage	TCV_O				mV/°C
I_O = 5.0 mA, 0°C ≤ T_A ≤ +125°C		–	-1.0	–	

The MC7815CP is a three-terminal positive 15 volt, voltage regulator that provides internal thermal overload protection and short circuit output current limiting.

FIGURE 4-14 MC7815CP, +15 VOLT VOLTAGE REGULATOR, IC DATA SHEET

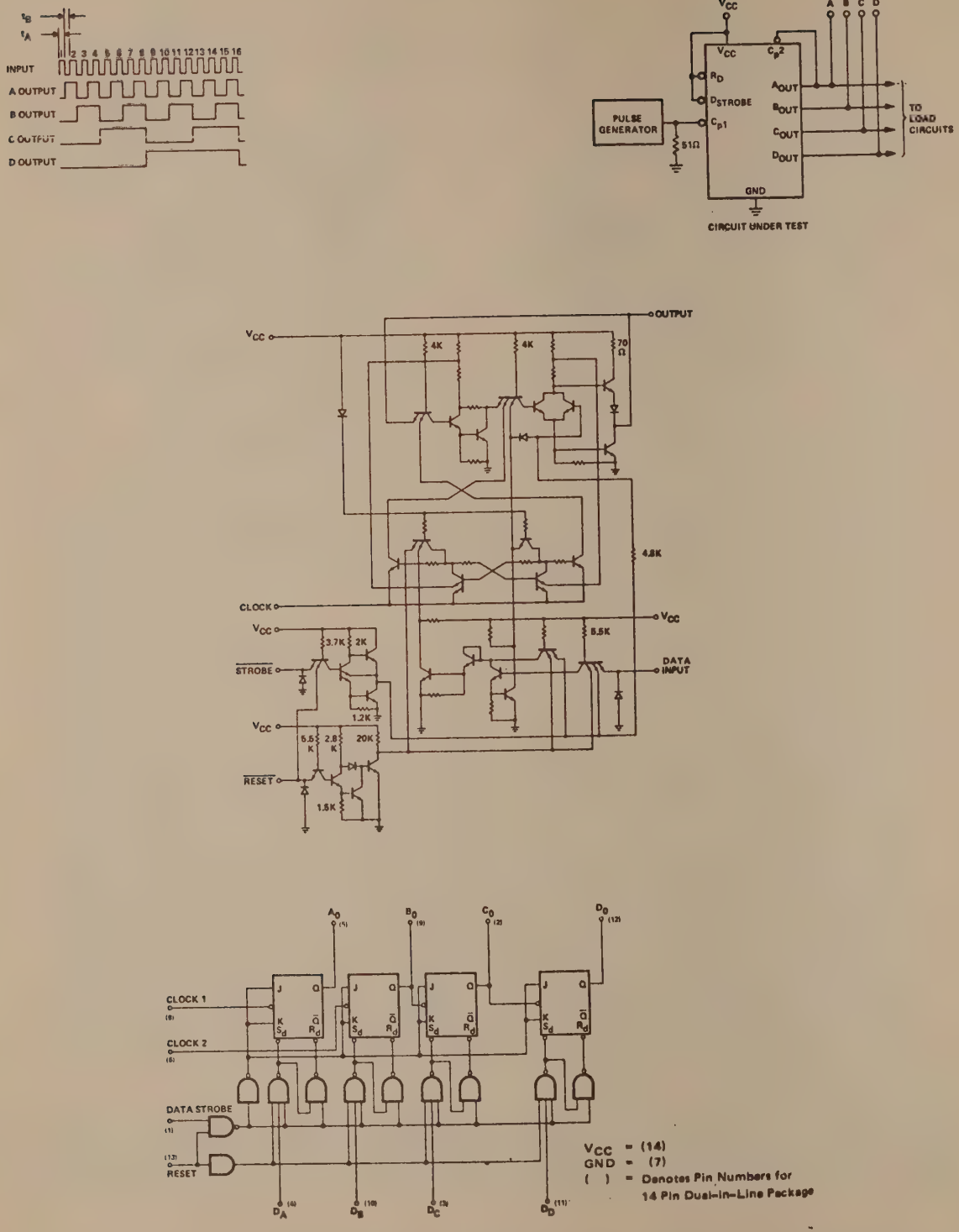
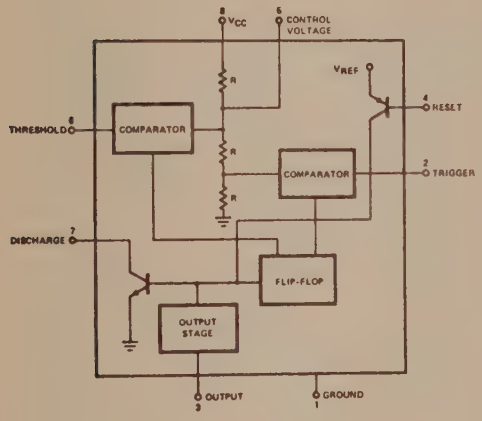
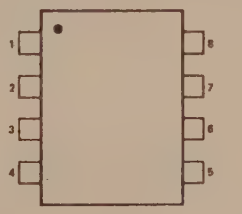


FIGURE 4-15 N8281, 4-BIT BINARY COUNTER/STORAGE ELEMENT, IC DATA SHEET

DESCRIPTION

The NE/SE 555 monolithic timing circuit is a highly stable controller capable of producing accurate time delays, or oscillation. Additional terminals are provided for triggering or resetting if desired. In the time delay mode of operation, the time is precisely controlled by one external resistor and capacitor. For a stable operation as an oscillator, the free running frequency and the duty cycle are both accurately controlled with two external resistors and one capacitor. The circuit may be triggered and reset on falling waveforms, and the output structure can source or sink up to 200 mA or drive TTL circuits.





(Top View)

1. Ground
2. Trigger
3. Output
4. Reset
5. Control Voltage
6. Threshold
7. Discharge
8. V_{CC}

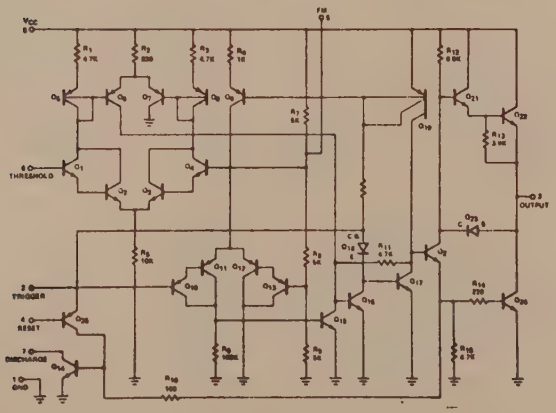


FIGURE 4-16 NE55A, TTL COMPATIBLE MONOLITHIC TIMER, IC DATA SHEET

ELECTRICAL CHARACTERISTICS (T_A = 25°C, V_{CC} = +5V to +15 unless otherwise specified)

PARAMETER	TEST CONDITIONS	SE 555			NE 555			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Supply Voltage		4.5		18	4.5		16	V
Supply Current	V_{CC} = 5V R_L = ∞		3	5		3	6	mA
	V_{CC} = 15V R_L = ∞		10	12		10	15	mA
	Low State, Note 1							
Timing Error	R_A, R_B = 1KΩ to 100KΩ							
Initial Accuracy	C = 0.1 μF Note 2		0.5	2		1		%
Drift with Temperature			30	100		50		ppm/°C
Drift with Supply Voltage			0.005	0.02		0.01		%/Volt
Threshold Voltage			2/3			2/3		X V_{CC}
Trigger Voltage	V_{CC} = 15V	4.8	5	5.2		5		V
	V_{CC} = 5V	1.45	1.67	1.9		1.67		V
Trigger Current			0.5			0.5		μA
Reset Voltage		0.4	0.7	1.0	0.4	0.7	1.0	V
Reset Current			0.1			0.1		mA
Threshold Current	Note 3		0.1	.25		0.1	.25	μA
Control Voltage Level	V_{CC} = 15V	9.6	10	10.4	9.0	10	11	V
	V_{CC} = 5V	2.9	3.33	3.8	2.6	3.33	4	V
Output Voltage Drop (low)	V_{CC} = 15V							
	I_{SINK} = 10mA		0.1	0.15		0.1	.25	V
	I_{SINK} = 50mA		0.4	0.5		0.4	.75	V
	I_{SINK} = 100mA		2.0	2.2		2.0	2.5	V
	I_{SINK} = 200mA		2.5			2.5		
	V_{CC} = 5V							
	I_{SINK} = 8mA		0.1	0.25				V
	I_{SINK} = 5mA					.25	.35	
Output Voltage Drop (high)								
	I_{SOURCE} = 200mA V_{CC} = 15V		12.5			12.5		
	I_{SOURCE} = 100mA							
	V_{CC} = 15V	13.0	13.3		12.75	13.3		V
	V_{CC} = 5V	3.0	3.3		2.75	3.3		V
Rise Time of Output			100			100		nsec
Fall Time of Output			100			100		nsec

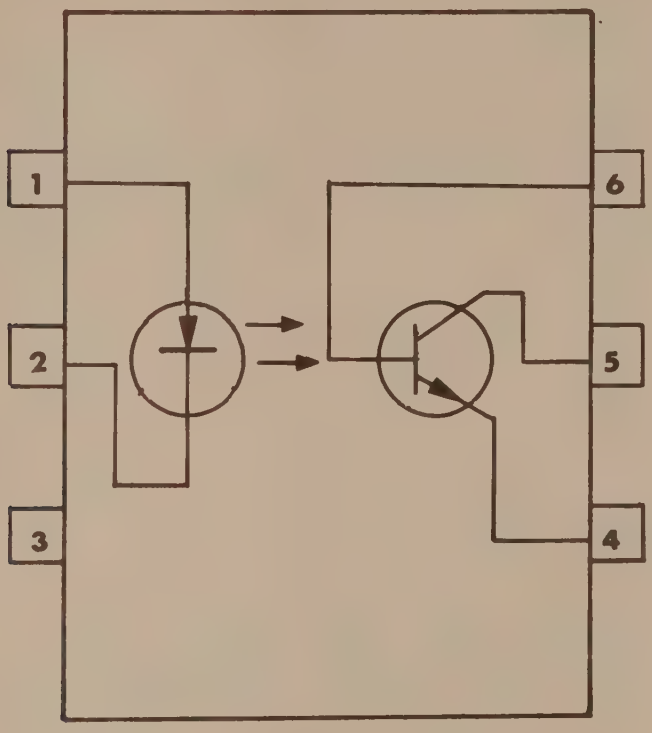
NOTES:

1. Supply Current when output high typically 1mA less.
2. Tested at V_{CC} = 5V and V_{CC} = 15V
3. This will determine the maximum value of R_A + R_B. For 15V operation, the max total R = 20 megohm.

FIGURE 4-16 NE55A, TTL COMPATIBLE MONOLITHIC TIMER, IC DATA SHEET (Cont'd)

DESCRIPTION

The 4N228 Opto-Isolator has a NPN silicon planar phototransistor coupled to a gallium arsenide LED, and is mounted in a six pin DIP package.



ABSOLUTE MAXIMUM RATINGS

*Storage temperature . . . . . −55°C to 150°C
*Operating temperature at junction . . . . . −55°C to 100°C
*Lead temperature (soldering, 10 sec) . . . . . 260°C
*Total package power dissipation at 25°C ambient (LED plus detector) . . . . . 250 mW
*Derate linearly from 25°C . . . . . 3.3 mW/°C

Input diode
- *Forward DC current continuous . . . . . 80 mA
- *Reverse voltage . . . . . 3.0 V
- *Peak forward current (1 μs pulse, 300 pps) . . . . . 3.0 A
- *Power dissipation at 25°C ambient . . . . . 150 mW
- *Derate linearly from 25°C . . . . . 2.0 mW/°C

Output transistor
- *Collector emitter voltage (BV_{CEO}) . . . . . 30 V
- *Collector base voltage (BV_{CBO}) . . . . . 70 V
- *Emitter collector voltage (BV_{ECO}) . . . . . 7 V
- *Power dissipation at 25°C ambient . . . . . 150 mW
- *Derate linearly from 25°C . . . . . 2.0 mW/°C

*Indicates JEDEC Registered Data.

FIGURE 4-17 4N228, PHOTOTRANSISTOR "OPTO-ISOLATOR", IC DATA SHEET

FUNCTIONAL DESCRIPTION

The 93L24 5-bit comparator uses combinational circuitry to directly generate "A greater than B" and "A less than B" outputs. As evident from the logic diagram, these outputs are generated in only three gate delays. The "A equals B" output is generated in one additional gate delay by decoding the "A neither less than nor greater than B" condition with a NOR gate. All three outputs are activated by the active LOW enable input ($\overline{E}$).

Tying the A>B output from one device into an A input on another device and the A<B output into the corresponding B input permits easy expansion as shown in Figure 1.

The A_4 and B_4 inputs are the most significant inputs and A_0, B_0 the least significant. Thus, if A_4 is HIGH and B_4 is LOW, the A>B output will be HIGH regardless of all other inputs except $\overline{E}$.

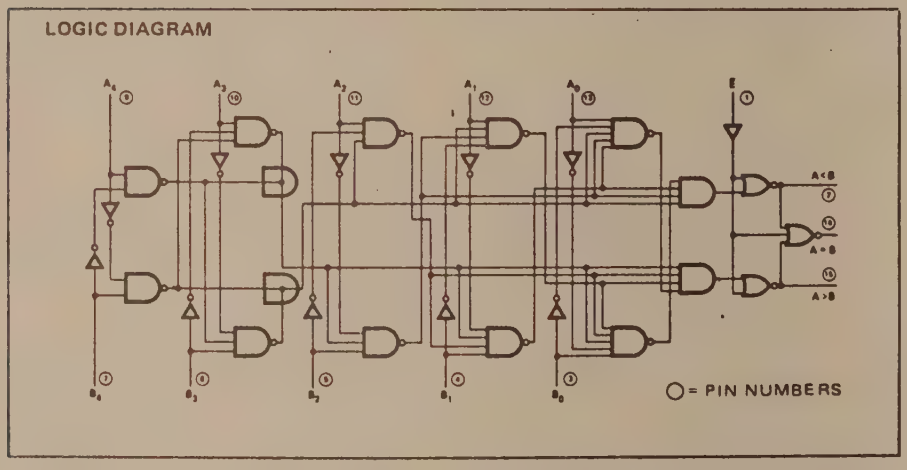


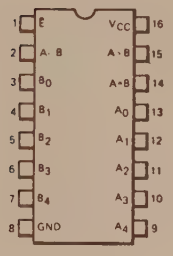
FIGURE 4-18 93L24, 5-BIT COMPARATOR, IC DATA SHEET

TRUTH TABLE

$\bar{E}$	A	B	A < B	A > B	A = B
H	X	X	L	L	L
L	Word A = Word B		L	L	H
L	Word A > Word B		L	H	L
L	Word A < Word B		H	L	L

L = LOW Voltage Level
H = HIGH Voltage Level
X = Either HIGH or LOW Voltage Level

CONNECTION DIAGRAMS
DIP (TOP VIEW)

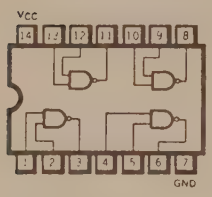


PIN NAMES

$\bar{E}$	Enable (Active LOW) Input
A_0, A_1, A_2, A_3, A_4	Word A Parallel Inputs
B_0, B_1, B_2, B_3, B_4	Word B Parallel Inputs
A < B	A Less than B Output
A > B	A Greater than B Output
A = B	A Equal to B Output

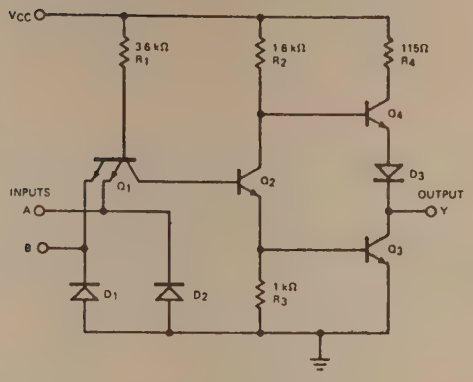
FIGURE 4-18 93L24, 5-BIT COMPARATOR, IC DATA SHEET (Cont'd)

DIP (TOP VIEW)



Positive logic: $Y = \overline{AB}$

SCHEMATIC DIAGRAM
(EACH GATE)



Component values shown are typical

ELECTRICAL CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE

SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP. (Note 2)	MAX.	
V_{IH}	Input HIGH Voltage	2.0			Volts
V_{IL}	Input LOW Voltage			0.8	Volts
V_{OH}	Output HIGH Voltage	2.4	3.3		Volts
V_{OL}	Output LOW Voltage		0.22	0.4	Volts
I_{IH}	Input HIGH Current			40	μA
				1.0	mA
I_{IL}	Input LOW Current			-1.6	mA
I_{OS}	Output Short Circuit Current	-20		-55	mA
	(Note 3)	-18		-55	mA
I_{CCH}	Supply Current HIGH		4.0	8.0	mA
I_{CCL}	Supply Current LOW		12	22	mA

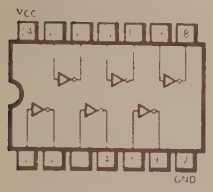
SWITCHING CHARACTERISTICS ($T_A = 25°C$)

SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP.	MAX.	
t_{PLH}	Turn Off Delay Input to Output		11	22	ns
t_{PHL}	Turn On Delay Input to Output		7.0	15	ns

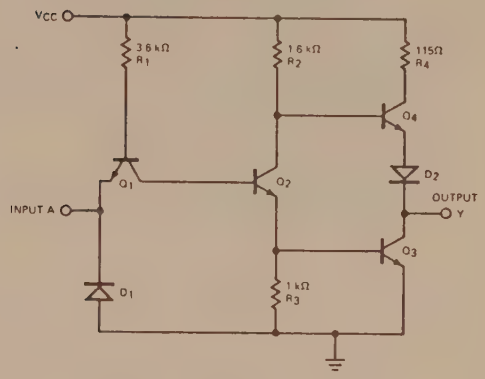
NOTES:
(1) For conditions shown as MIN. or MAX., use the appropriate value specified under device type.
(2) Typical limits are at $V_{CC} = 5.0$ V, 25°C.
(3) Note more than one output should be shorted at a time.

FIGURE 4-19 7400, QUAD 2-INPUT POSITIVE "NAND" GATE, IC DATA SHEET

DIP (TOP VIEW)



SCHEMATIC DIAGRAM
(EACH INVERTER)



Component values shown are typical.

ELECTRICAL CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE

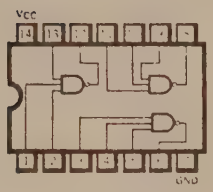
SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP. (Note 2)	MAX.	
V_{IH}	Input HIGH Voltage	2.0			Volts
V_{IL}	Input LOW Voltage			0.8	Volts
V_{OH}	Output HIGH Voltage	2.4	3.3		Volts
V_{OL}	Output LOW Voltage		0.22	0.4	Volts
I_{IH}	Input HIGH Current			40	μA
				1.0	mA
I_{IL}	Input LOW Current			-1.6	mA
I_{OS}	Output Short Circuit Current	-20		-55	mA
	(Note 3)	-18		-55	mA
I_{CCH}	Supply Current HIGH		6.0	12	mA
I_{CCL}	Supply Current LOW		18	33	mA

SWITCHING CHARACTERISTICS (T_A = 25°C)

SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP.	MAX.	
t_{PLH}	Turn Off Delay Input to Output		12	22	ns
t_{PHL}	Turn On Delay Input to Output		8.0	15	ns

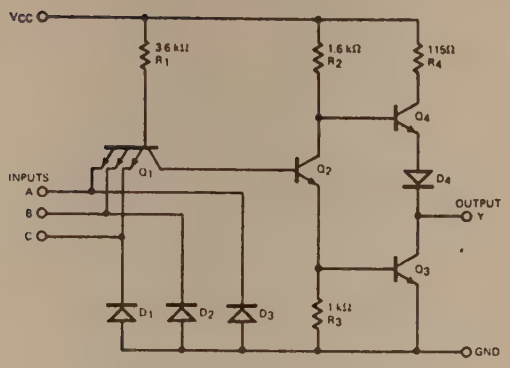
FIGURE 4-20 7404, HEX INVERTER, IC DATA SHEET

DIP (TOP VIEW)



Positive logic: $Y = \overline{ABC}$

SCHEMATIC DIAGRAM
(EACH GATE)



Component values shown are typical.

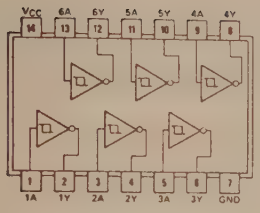
ELECTRICAL CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE

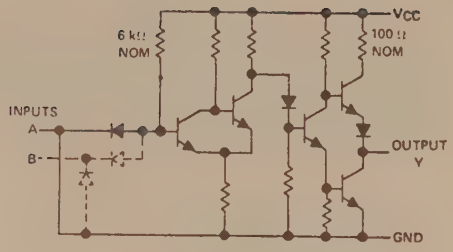
SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP. (Note 2)	MAX.	
V_{IH}	Input HIGH Voltage	2.0			Volts
V_{IL}	Input LOW Voltage			0.8	Volts
V_{OH}	Output HIGH Voltage	2.4	3.3		Volts
V_{OL}	Output LOW Voltage		0.22	0.4	Volts
I_{IH}	Input HIGH Current			40	μA
				1.0	mA
I_{IL}	Input LOW Current			−1.6	mA
I_{OS}	Output Short Circuit Current	−20		−55	mA
	(Note 3)	−18		−55	mA
I_{CCH}	Supply Current HIGH		3.0	6.0	mA
I_{CCL}	Supply Current LOW		9.0	16.5	mA

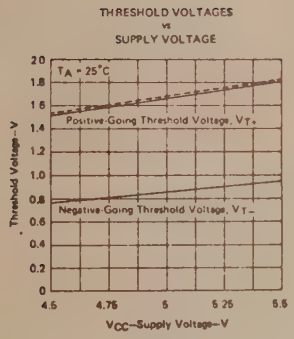
SWITCHING CHARACTERISTICS (T_A = 25°C)

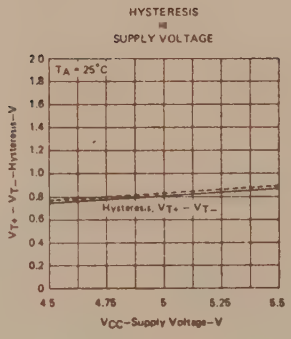
SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP.	MAX.	
t_{PLH}	Turn Off Delay Input to Output		11	22	ns
t_{PHL}	Turn On Delay Input to Output		7.0	15	ns

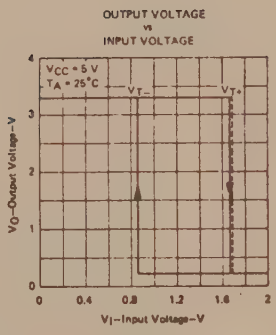
FIGURE 4-21 7410, TRIPLE 3-INPUT POSITIVE "NAND" GATE, IC DATA SHEET











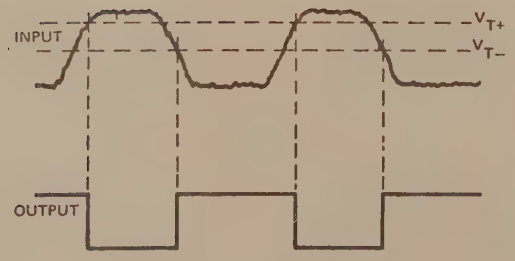


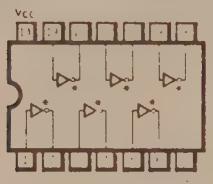
FIGURE 4-22 7414, HEX SCHMITT TRIGGER INVERTER, IC DATA SHEET

HEX INVERTER BUFFER/DRIVER
(WITH OPEN-COLLECTOR HIGH-VOLTAGE OUTPUT)

DESCRIPTION

The 7416 hex inverter buffer/driver feature high voltage open collector output for interfacing with high level circuits (such as MOS), or for driving high current loads (such as lamps or relays) and are also characterized for use as inverter buffers for driving TTL inputs. For increased fan out, several inverters in a single package may be paralleled.

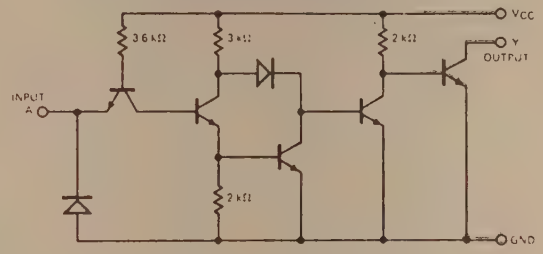
DIP (TOP VIEW)



*OPEN COLLECTOR

Positive logic = Y = $\overline{A}$

SCHEMATIC DIAGRAM
(EACH INVERTER)



Component values shown are typical.

ELECTRICAL CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE

SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP. (Note 2)	MAX.	
V_{IH}	Input HIGH Voltage	2.0			Volts
V_{IL}	Input LOW Voltage			0.8	Volts
I_{OH}	Output HIGH Current			0.25	mA
V_{OL}	Output LOW Voltage			0.7	Volts
				0.4	Volts
I_{IH}	Input HIGH Current			40	μA
				1.0	mA
I_{IL}	Input LOW Current			-1.6	mA
I_{CCH}	Supply Current HIGH		30	42	mA
I_{CCL}	Supply Current LOW		27	38	mA

SWITCHING CHARACTERISTICS (T_A = 25°C)

SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP.	MAX.	
t_{PLH}	Turn Off Delay Input to Output		10	15 *	ns
t_{PHL}	Turn On Delay Input to Output		15	23	ns

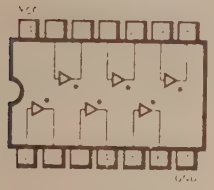
FIGURE 4-23 7416, HEX INVERTER BUFFER/DRIVER, IC DATA SHEET

HEX BUFFER/DRIVER
(WITH OPEN-COLLECTOR HIGH-VOLTAGE OUTPUT)

DESCRIPTION

The 7417 hex buffer/driver feature high voltage open collector output for interfacing with high level circuits (such as MOS), or for driving high current loads (such as lamps or relays) and are also characterized for use as buffers for driving TTL inputs. For increased fan out, several buffers in a single package may be paralled.

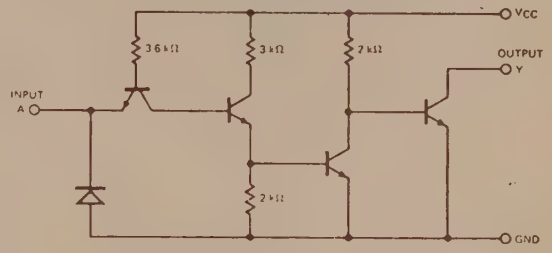
DIP (TOP VIEW)



*OPEN COLLECTOR

Positive logic: Y = A

SCHEMATIC DIAGRAM
(EACH BUFFER/DRIVER)



Component values shown are typical.

ELECTRICAL CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE

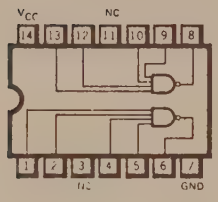
SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP. (Note 2)	MAX.	
V_{IH}	Input HIGH Voltage	2.0			Volts
V_{IL}	Input LOW Voltage			0.8	Volts
I_{OH}	Output HIGH Current			0.25	mA
V_{OL}	Output LOW Voltage			0.7	Volts
				0.4	Volts
I_{IH}	Input HIGH Current			40	μA
				1.0	mA
I_{IL}	Input LOW Current			−1.6	mA
I_{CCH}	Supply Current HIGH		29	41	mA
I_{CCL}	Supply Current LOW		21	30	mA

SWITCHING CHARACTERISTICS (T_A = 25°C)

SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP.	MAX.	
t_{PLH}	Turn Off Delay Input to Output		6.0	10	ns
t_{PHL}	Turn On Delay Input to Output		20	30	ns

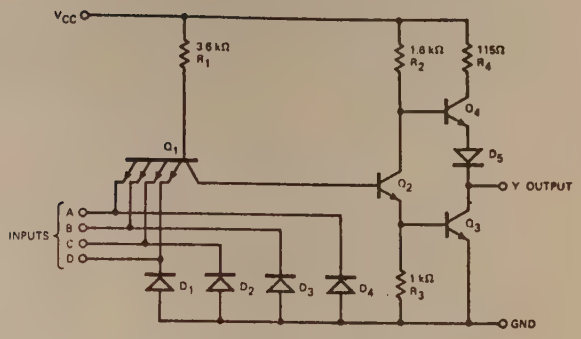
FIGURE 4-24 7417, HEX BUFFER/DRIVER, IC DATA SHEET

DIP (TOP VIEW)



Positive logic: $Y = \overline{ABCD}$

SCHEMATIC DIAGRAM
(EACH GATE)



Component values shown are typical.

ELECTRICAL CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE

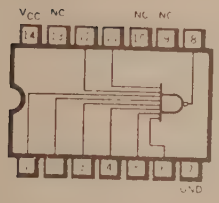
SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP. (Note 2)	MAX.	
V_{IH}	Input HIGH Voltage	2.0			Volts
V_{IL}	Input LOW Voltage			0.8	Volts
V_{OH}	Output HIGH Voltage	2.4	3.3		Volts
V_{OL}	Output LOW Voltage		0.22	0.4	Volts
I_{IH}	Input HIGH Current			40	μA
				1.0	mA
I_{IL}	Input LOW Current			−1.6	mA
I_{OS}	Output Short Circuit Current	−20		−55	mA
	(Note 3)	−18		−55	mA
I_{CCH}	Supply Current HIGH		2.0	4.0	mA
I_{CCL}	Supply Current LOW		6.0	11	mA

SWITCHING CHARACTERISTICS (T_A = 25°C)

SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP.	MAX.	
t_{PLH}	Turn Off Delay Input to Output		12	22	ns
t_{PHL}	Turn On Delay Input to Output		8.0	15	ns

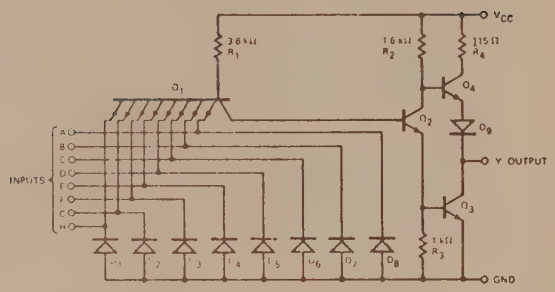
FIGURE 4-25 7420, DUAL 4-INPUT POSITIVE "NAND" GATE, IC DATA SHEET

DIP (TOP VIEW)



Positive logic: $Y = \overline{ABCDEFGH}$

SCHEMATIC DIAGRAM



Component values shown are typical.

ELECTRICAL CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE

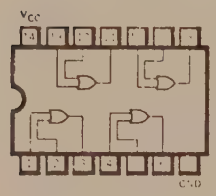
SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP. (Note 2)	MAX.	
V_{IH}	Input HIGH Voltage	2.0			Volts
V_{IL}	Input LOW Voltage			0.8	Volts
V_{OH}	Output HIGH Voltage	2.4	3.3		Volts
V_{OL}	Output LOW Voltage		0.22	0.4	Volts
I_{IH}	Input HIGH Current			40	μA
				1.0	mA
I_{IL}	Input LOW Current			-1.6	mA
I_{OS}	Output Short Circuit Current	-20		-55	mA
	(Note 3)	-18		-55	mA
I_{CCH}	Supply Current HIGH		1.0	2.0	mA
I_{CCL}	Supply Current LOW		3.0	6.0	mA

SWITCHING CHARACTERISTICS ($T_A = 25°C$)

SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP.	MAX.	
t_{PLH}	Turn Off Delay Input to Output		13	22	ns
t_{PHL}	Turn On Delay Input to Output		8.0	15	ns

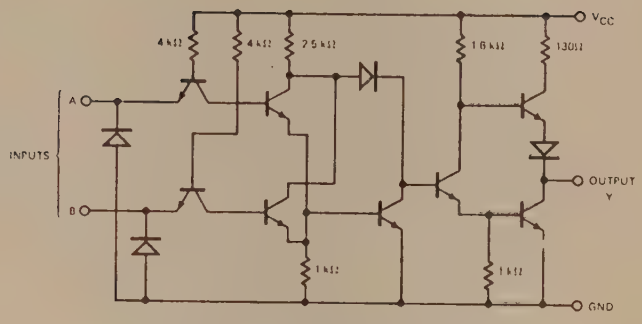
FIGURE 4-26 7430, 8-INPUT POSITIVE "NAND" GATE, IC DATA SHEET

DIP (TOP VIEW)



Positive logic: Y = A+B

SCHEMATIC DIAGRAM
(EACH GATE)



Component values shown are typical.

ELECTRICAL CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE

SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP. (Note 2)	MAX.	
V_{IH}	Input HIGH Voltage	2.0			Volts
V_{IL}	Input LOW Voltage			0.8	Volts
V_{CD}	Input Clamp Diode Voltage			−1.5	Volts
V_{OH}	Output HIGH Voltage	2.4	3.3		Volts
V_{OL}	Output LOW Voltage		0.22	0.4	Volts
I_I	Input Current at Maximum Input Voltage			1.0	mA
I_{IH}	Input HIGH Current			40	μA
I_{IL}	Input LOW Current			−16	mA
I_{OS}	Output Short Circuit Current (Note 3)	−20		−55	mA
		−18		−55	mA
I_{CCH}	Supply Current HIGH		15	22	mA
I_{CCL}	Supply Current LOW		23	38	mA

SWITCHING CHARACTERISTICS (T_A = 25°C)

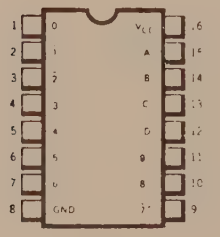
SYMBOL	PARAMETER	LIMITS			UNITS
		MIN.	TYP.	MAX.	
t_{PLH}	Turn Off Delay Input to Output		10	15	ns
t_{PHL}	Turn On Delay Input to Output		14	22	ns

FIGURE 4-27 7432, QUAD 2-INPUT "NAND" GATE, IC DATA SHEET

DESCRIPTION

These monolithic Decimal Decoders consist of eight inverters and ten 4-input NAND gates. The inverters are connected in pairs to make BCD input data available for decoding by the NAND gates. Full decoding of valid input logic ensures that all outputs remain off for all invalid input conditions.

CONNECTION DIAGRAM
DIP (TOP VIEW)



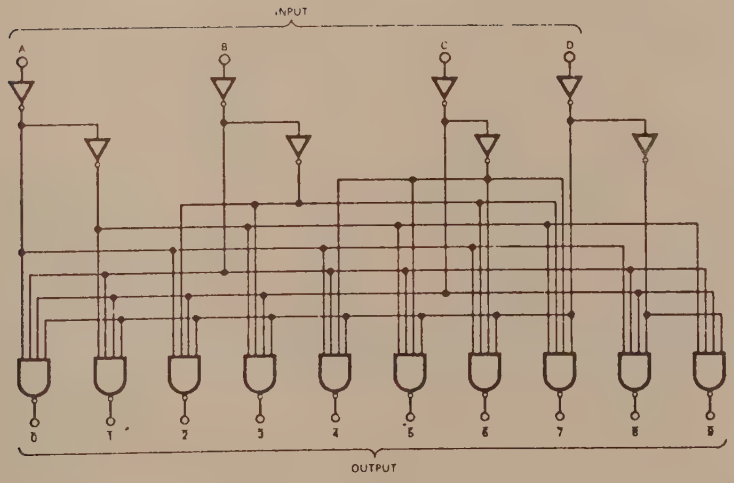
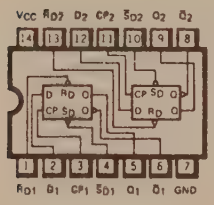


FIGURE 4-28 7442N, BCD-TO-DECIMAL DECODER, IC DATA SHEET

DESCRIPTION

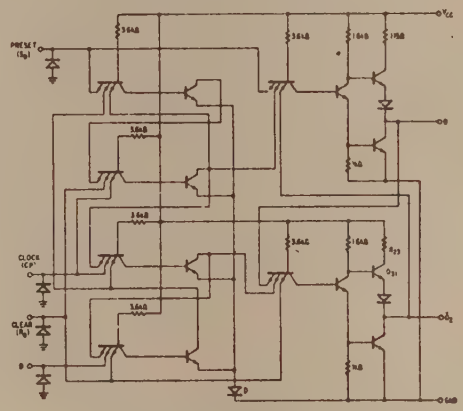
The 7474 is a edge triggered dual D type flip-flops with direct clear and present inputs and both, Q and $\overline{Q}$ outputs. Information at the input is transferred to the outputs on the positive edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive going pulse. After the clock input threshold voltage has been passed, the data input (D) is locked out and information present will not be transferred to the output.

DIP (TOP VIEW)



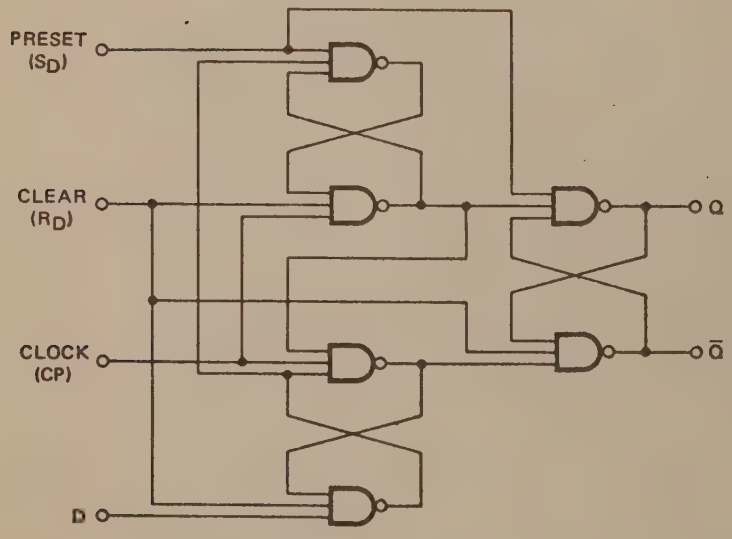
Positive logic:
- LOW input to preset sets Q to HIGH level
- LOW input to clear sets Q to LOW level
- Preset and clear are independent of clock

SCHEMATIC DIAGRAM (EACH FLIP-FLOP)



Component values shown are typical.

LOGIC DIAGRAM (EACH FLIP-FLOP)



TRUTH TABLE (Each Flip-Flop)

t_n	· t_{n+1}	
INPUT D	OUTPUT Q	OUTPUT $\overline{Q}$
L	L	H
H	H	L

NOTES:
t_n = bit time before clock pulse.
t_{n+1} = bit time after clock pulse.

FIGURE 4-29 7474, DUAL D TYPE EDGE TRIGGERED FLIP-FLOP, IC DATA SHEET

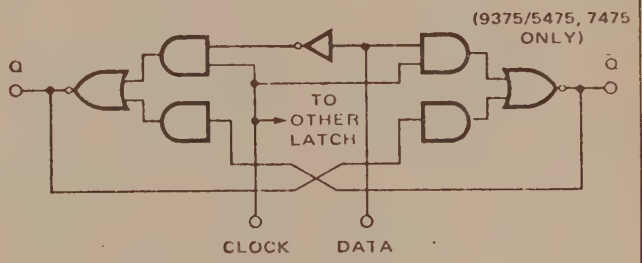
DESCRIPTION

The 7475 latch is used as temporary storage for binary information. Information present at a data (D) input is transferred to the Q output when the clock is HIGH and the Q output will follow the data input as long as the clock remains HIGH. When the clock goes LOW, the information (that was present at the data input at the time the transition occurred) is retained at the Q output until the clock is permitted to go HIGH.

DIP (TOP VIEW)

Positive logic: See truth table.
NC — No internal connection.

LOGIC DIAGRAM
(EACH LATCH)



PIN NAMES

D_1, D_2, D_3, D_4	Data Inputs
$\overline{CP}_{1-2}$	Clock Input Latches 1 & 2
$\overline{CP}_{3-4}$	Clock Input Latches 3 & 4
Q_1, Q_2, Q_3, Q_4	Latch Outputs
$\overline{Q}_1, \overline{Q}_2, \overline{Q}_3, \overline{Q}_4$	Complementary Latch Outputs

TRUTH TABLE
(Each Latch)

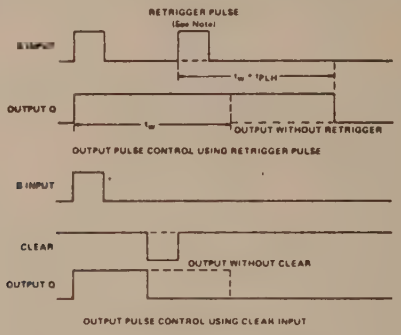
t_n	t_{n+1}
D	Q
H	H
L	L

NOTES:
t_n = bit time before clock negative-going transition.
t_{n+1} = bit time after clock negative-going transition.

FIGURE 4-30 7475, 4-BIT BISTABLE LATCH, IC DATA SHEET

description

The '122, '123, 'L122, and 'L123 multivibrators feature d-c triggering from gated low-level-active (A) and high-level-active (B) inputs, and also provide overriding direct clear inputs. Complementary outputs are provided. The retrigger capability simplifies the generation of output pulses of extremely long duration. By triggering the input before the output pulse is terminated, the output pulse may be extended. The overriding clear capability permits any output pulse to be terminated at a predetermined time independently of the timing components R and C. Figure A below illustrates triggering the one-shot with the high-level-active (B) inputs.



NOTE: Retrigger pulse must not start before 0.22 C_{ext} (in picofarads) nanoseconds after previous trigger pulse.

FIGURE A–TYPICAL INPUT/OUTPUT PULSES

These monostables are designed to provide the system designer with complete flexibility in controlling the pulse width, either to lengthen the pulse by retriggering, or to shorten by clearing. The '122 and 'L122 each has an internal timing resistor which allows the circuit to be operated with only an external capacitor, if so desired. Applications requiring more precise pulse widths (up to 28 seconds) and not requiring the clear feature can best be satisfied with '121 or 'L121.

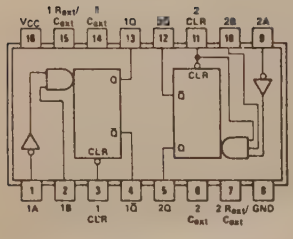
The output pulse is primarily a function of the external capacitor and resistor. For $C_{ext} > 1000$ pF, the output pulse width (t_w) is defined as:

$$t_w = K \cdot R_T \cdot C_{ext} \left(1 + \frac{0.7}{R_T}\right)$$

where

R_T is in kΩ (either internal or external timing resistor),
C_{ext} is in pF,
t_w is in ns,
K is 0.32 for '122, 0.28 for '123, 0.37 for 'L122, 0.33 for 'L123.

For pulse widths when $C_{ext} \leq 1000$ pF, see Figures B and C.



FUNCTION TABLE

INPUTS			OUTPUTS	
CLEAR	A	B	Q	$\bar{Q}$
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↑	⎍	⎍
H	↓	H	⎍	⎍
↑	L	H	⎍	⎍

TYPICAL OUTPUT PULSE WIDTH
vs
EXTERNAL TIMING CAPACITANCE

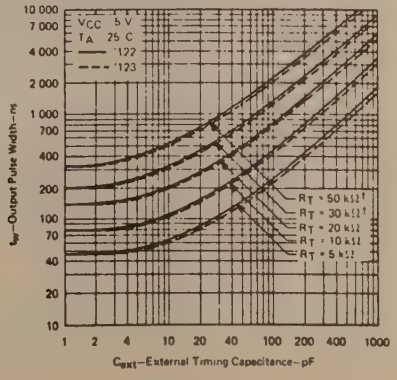
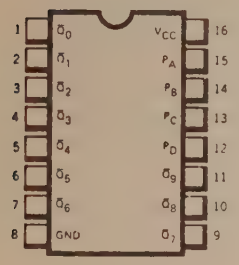


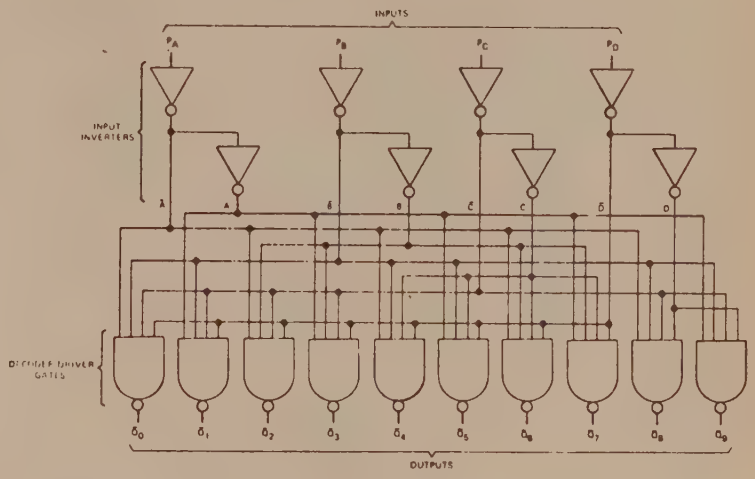
FIGURE 4-31 74123, DUAL MONOSTABLE M.V., IC DATA SHEET

DESCRIPTION

The 74145 1-of-10 Decoder/Drivers is designed to accept BCD inputs and provide appropriate outputs to drive 10 digit incandescent displays. All outputs remain off for all invalid binary input conditions. Each of the high breakdown output transistors will sink up to 80 mA of current. Typical power dissipation is 215 mW.

CONNECTION DIAGRAM
DIP (TOP VIEW)





PIN NAMES

P_A, P_B, P_C, P_D	BCD Inputs
$\bar{Q}_0$ to $\bar{Q}_9$	Outputs

TRUTH TABLE

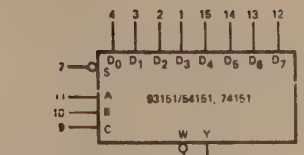
INPUTS				OUTPUTS									
P_D	P_C	P_B	P_A	$\bar{Q}_0$	$\bar{Q}_1$	$\bar{Q}_2$	$\bar{Q}_3$	$\bar{Q}_4$	$\bar{Q}_5$	$\bar{Q}_6$	$\bar{Q}_7$	$\bar{Q}_8$	$\bar{Q}_9$
L	L	L	L	L	H	H	H	H	H	H	H	H	H
L	L	L	H	H	L	H	H	H	H	H	H	H	H
L	L	H	L	H	H	L	H	H	H	H	H	H	H
L	L	H	H	H	H	H	L	H	H	H	H	H	H
L	H	L	L	H	H	H	H	L	H	H	H	H	H
L	H	L	H	H	H	H	H	H	L	H	H	H	H
L	H	H	L	H	H	H	H	H	H	L	H	H	H
L	H	H	H	H	H	H	H	H	H	H	L	H	H
H	L	L	L	H	H	H	H	H	H	H	H	L	H
H	L	L	H	H	H	H	H	H	H	H	H	H	L
H	L	H	L	H	H	H	H	H	H	H	H	H	H
H	L	H	H	H	H	H	H	H	H	H	H	H	H
H	H	L	L	H	H	H	H	H	H	H	H	H	H
H	H	L	H	H	H	H	H	H	H	H	H	H	H
H	H	H	L	H	H	H	H	H	H	H	H	H	H
H	H	H	H	H	H	H	H	H	H	H	H	H	H

H = HIGH Voltage Level
L = LOW Voltage Level

FIGURE 4-32 74145N, BCD-TO-DECIMAL DECODER/DRIVER, IC DATA SHEET

DESCRIPTION

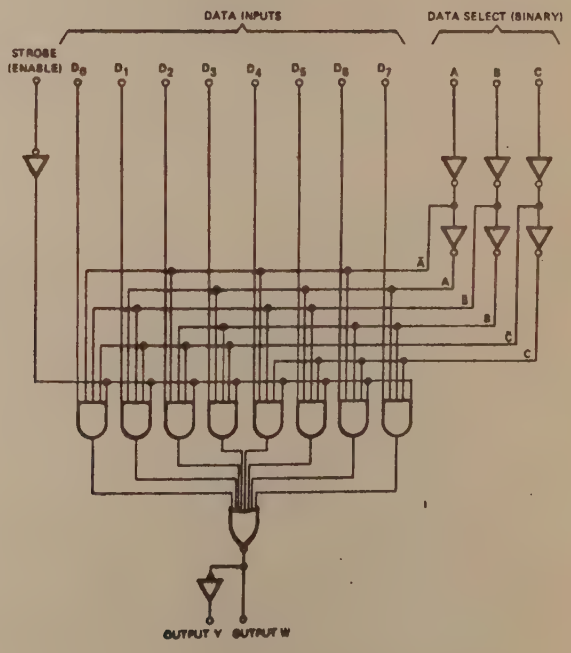
The 74151 is an 8-Input Multiplexer with active LOW strobe, internal select decoding and complementary outputs.



VCC = PIN 16
GND = PIN 8

PIN NAMES

E_0 to E_{15}	Data Inputs
D_0 to D_7	Data Inputs
$\overline{S}$	Strobe (Enable) Input
A, B, C, D	Data Select Inputs
$\overline{W}$	Data Output
Y	Data Output



INPUTS										OUTPUTS	
C	B	A	STROBE(1)	D_0	D_1	D_2	D_3	D_4	D_5	D_6	D_7	Y(1)	W
X	X	X	H	X	X	X	X	X	X	X	X	L	H
L	L	L	L	L	X	X	X	X	X	X	X	L	H
L	L	L	L	H	X	X	X	X	X	X	X	H	L
L	L	H	L	X	L	X	X	X	X	X	X	L	H
L	L	H	L	X	H	X	X	X	X	X	X	H	L
L	H	L	L	X	X	L	X	X	X	X	X	L	H
L	H	L	L	X	X	H	X	X	X	X	X	H	L
L	H	H	L	X	X	X	L	X	X	X	X	L	H
L	H	H	L	X	X	X	H	X	X	X	X	H	L
H	L	L	L	X	X	X	X	L	X	X	X	L	H
H	L	L	L	X	X	X	X	H	X	X	X	H	L
H	L	H	L	X	X	X	X	X	L	X	X	L	H
H	L	H	L	X	X	X	X	X	H	X	X	H	L
H	H	L	L	X	X	X	X	X	X	L	X	L	H
H	H	L	L	X	X	X	X	X	X	H	X	H	L
H	H	H	L	X	X	X	X	X	X	X	L	L	H
H	H	H	L	X	X	X	X	X	X	X	H	H	L

NOTES:
1. 54151, 74151 only.
2. When used to indicate an input, X = Irrelevant.

Positive Logic

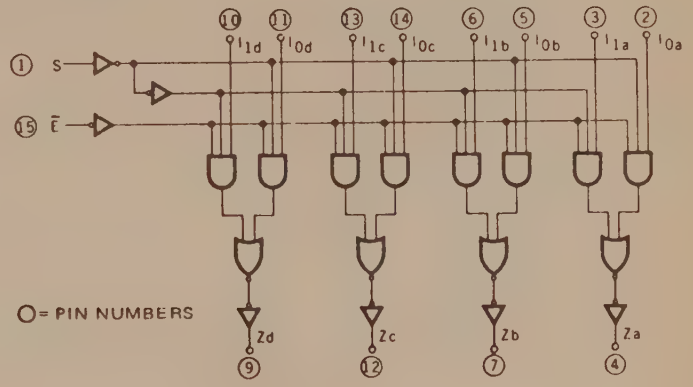
$$Y = \overline{S}(\bar{A}\bar{B}\bar{C}D_0 + A\bar{B}\bar{C}D_1 + \bar{A}B\bar{C}D_2 + AB\bar{C}D_3 + \bar{A}\bar{B}CD_4 + A\bar{B}CD_5 + \bar{A}BCD_6 + ABCD_7) \quad W = \overline{Y}$$

FIGURE 4-33 74151, DATA SELECTOR/MULTIPLEXER, IC DATA SHEET

DESCRIPTION

The 74157 is a Monolithic, High Speed, Quad Two-Input Digital Multiplexer Circuit. It consists of four multiplexing circuits with common select and enable logic; each circuit contains two inputs and one output. The circuit uses TTL for high speed, high fan out operation and is compatible with all other members of the TTL family.

LOGIC DIAGRAM



TRUTH TABLE

ENABLE	SELECT INPUT	INPUTS		OUTPUT
$\bar{E}$	S	I_{0X}	I_{1X}	Z_X
H	X	X	X	L
L	H	X	L	L
L	H	X	H	H
L	L	L	X	L
L	L	H	X	H

H = HIGH Voltage Level
L = LOW Voltage Level
X = Either HIGH or LOW Logic Level

PIN NAMES

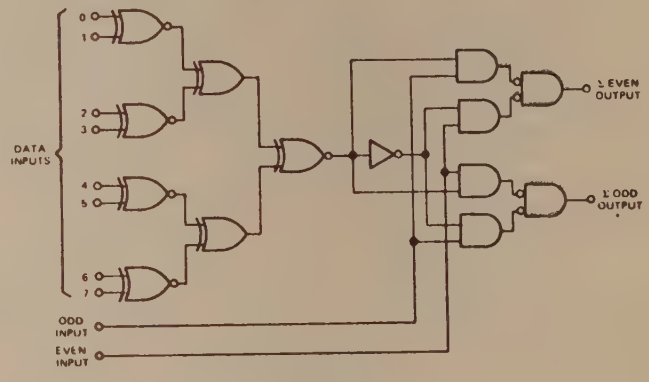
S	Common Selected Input
$\bar{E}$	Enable (Active LOW) Inputs
$I_{0a}, I_{1a}, I_{0b}, I_{1b}, I_{0c}, I_{1c}, I_{0d}, I_{1d}$	Multiplexer Inputs
Z_a, Z_b, Z_c, Z_d	Multiplexer Output

FIGURE 4-34 74157, QUAD 2-LINE-TO-1-LINE SELECTOR/MULTIPLEXER, IC DATA SHEET

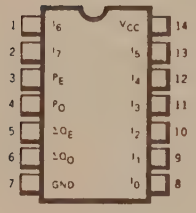
DESCRIPTION

The 74180 is a monolithic, 8-Bit Parity Check/Generator which feature control inputs and even/odd outputs to enhance operation in either odd or even parity applications. Cascading these circuits allows unlimited work length expansion. Typical application would be to generate and check parity on data being transmitted from one register to another. Typical power dissipation is 170 mV.

LOGIC DIAGRAM



CONNECTION DIAGRAM
DIP (TOP VIEW)



TRUTH TABLE

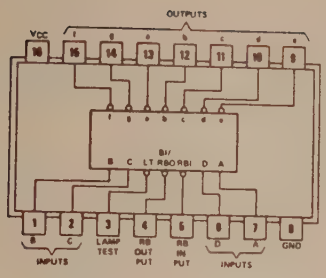
INPUTS			OUTPUTS	
Σ OF 1's AT 0 THRU 7	EVEN	ODD	Σ EVEN	Σ ODD
EVEN	H	L	H	L
ODD	H	L	L	H
EVEN	L	H	L	H
ODD	L	H	H	L
X	H	H	L	L
X	L	L	H	H

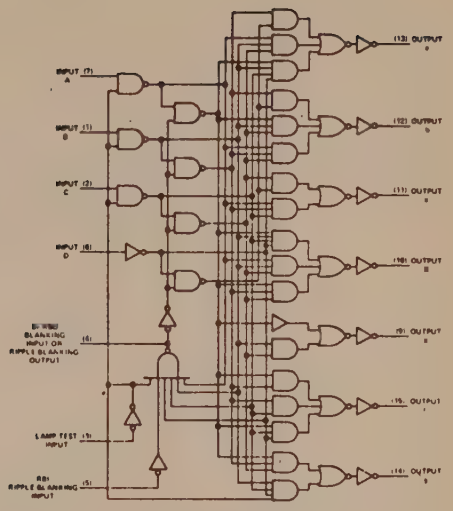
X = irrelevant

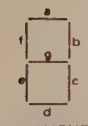
PIN NAMES

I_0 to I_7	Parity Inputs
P_O	Odd Parity Input
P_E	Even Parity Input
ΣQ_O	Sum Odd Outputs
ΣQ_E	Sum Even Outputs

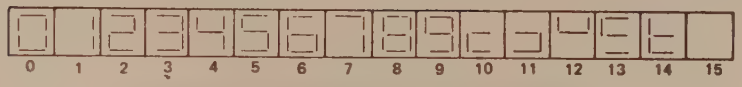
FIGURE 4-35 74180, 9-BIT ODD/EVEN PARITY GENERATOR/CHECKER, IC DATA SHEET







SEGMENT IDENTIFICATION



NUMERICAL DESIGNATIONS AND RESULTANT DISPLAYS

FUNCTION TABLE

DECIMAL OR FUNCTION	INPUTS						BI/RBO†	OUTPUTS							NOTE
	LT	RBI	D	C	B	A		a	b	c	d	e	f	g	
0	H	H	L	L	L	L	H	ON	ON	ON	ON	ON	ON	OFF	1
1	H	X	L	L	L	H	H	OFF	ON	ON	OFF	OFF	OFF	OFF	
2	H	X	L	L	H	L	H	ON	ON	OFF	ON	ON	OFF	ON	
3	H	X	L	L	H	H	H	ON	ON	ON	ON	OFF	OFF	ON	
4	H	X	L	H	L	L	H	OFF	ON	ON	OFF	OFF	ON	ON	
5	H	X	L	H	L	H	H	ON	OFF	ON	ON	OFF	ON	ON	
6	H	X	L	H	H	L	H	ON	OFF	ON	ON	ON	ON	ON	
7	H	X	L	H	H	H	H	ON	ON	ON	OFF	OFF	OFF	OFF	
8	H	X	H	L	L	L	H	ON	ON	ON	ON	ON	ON	ON	
9	H	X	H	L	L	H	H	ON	ON	ON	ON	OFF	ON	ON	
10	H	X	H	L	H	L	H	OFF	OFF	OFF	ON	ON	OFF	ON	
11	H	X	H	L	H	H	H	OFF	OFF	ON	ON	OFF	OFF	ON	
12	H	X	H	H	L	L	H	OFF	ON	OFF	OFF	OFF	ON	ON	
13	H	X	H	H	L	H	H	ON	OFF	OFF	ON	OFF	ON	ON	
14	H	X	H	H	H	L	H	OFF	OFF	OFF	ON	ON	ON	ON	
15	H	X	H	H	H	H	H	OFF	OFF	OFF	OFF	OFF	OFF	OFF	
BI	X	X	X	X	X	X	L	OFF	OFF	OFF	OFF	OFF	OFF	OFF	2
RBI	H	L	L	L	L	L	L	OFF	OFF	OFF	OFF	OFF	OFF	OFF	3
LT	L	X	X	X	X	X	H	ON	ON	ON	ON	ON	ON	ON	4

H = high level, L = low level, X = irrelevant

NOTES:
1. The blanking input (BI) must be open or held at a high logic level when output functions 0 through 15 are desired. The ripple-blanking input (RBI) must be open or high if blanking of a decimal zero is not desired.
2. When a low logic level is applied directly to the blanking input (BI), all segment outputs are off regardless of the level of any other input.
3. When ripple-blanking input (RBI) and inputs A, B, C, and D are at a low level with the lamp test input high, all segment outputs go off and the ripple-blanking output (RBO) goes to a low level (response condition).
4. When the blanking input/ripple blanking output (BI/RBO) is open or held high and a low is applied to the lamp-test input, all segment outputs are on.

†BI/RBO is wire-AND logic serving as blanking input (BI) and/or ripple-blanking output (RBO).

FIGURE 4-36 74247N, BCD-TO-SEVEN SEGEMENT DECODER/DRIVER, IC DATA SHEET

CHAPTER 5
MAINTENANCE AND CALIBRATION

5.1 INTRODUCTION

This chapter provides the Performance Tests, Preliminary Maintenance and Calibration procedures for the Model DPSD-50 Digital Power Source. Location of the internal adjustment and test points for the Model DPSD-50 is provided by Figure 5-1.

5.2 TEST AND CALIBRATION EQUIPMENT

Table 5-1 lists the test equipment required to perform the various procedures described in this chapter.

TABLE 5-1 REQUIRED TEST EQUIPMENT

TYPE	REQUIRED CHARACTERISTICS	RECOMMENDED MODEL
Metered Line Variac	103 Vac to 127 Vac, 3A	
2 each, variable Load Resistors	0 to 1 kΩ, 75 watts	
Electrolytic Capacitor	250 µFd, >60 WVDC	
2 each, 44- pin Extender Boards		Systron-Donner P/N 73000-974
Oscilloscope	1 mV p-p resolution dual vertical inputs, "chopped" mode	Tektronix Model 545
2 each, Digital Multimeter (DMM)	VAC rms, DCV, and DC Current functions	Systron-Donner Model 7004A

5.3 CHECKOUT PROCEDURE

1. Check that a 3A 3AG fuse is installed in the rear panel fuse holder, and that a 4A 3AG fuse is installed in the right gusset heat sink fuse holder.

2. Remove the nine plug-in PCB from the two Mother Boards.

3. Ensure that the rear panel power swtich is in the 115V position.

4. Apply ac line voltage via a metered variaç. Press the front panel power switch and bring-up the line voltage slowly while monitoring the following listed power supply outputs across their associated filter capacitors.

+10V Digital	C2
+5V Digital	C3
+5V Analog (A)	C5
+5V Analog (B)	C11
+15V Analog (A)	C7
+15V Analog (B)	C13
-15V Analog (A)	C9
-15V Analog (B)	C15

If any of the power supplies do not come up to their normal voltage immediately remove power, locate and correct the fault. Verify that the four 15 volt supplies output 15 volts ±0.5 volts and that the three 5 volt supplies outputs 5 volts ±0.2 volts.

5.4 PERFORMANCE TEST AND CALIBRATION PROCEDURES

The following procedures are structured as a combined performance standard, calibration procedure and fault isolation procedure. First the digital control and programming functions are tested utilizing the readout display whenever possible, the exception being the Over Voltage and Over Current functions which are not digitally displayed and are verified by logic level configuration. Next the analog functions and their required adjustments are performed as two seperate sub-proceudres, one for the Source A circuits and the other for the Source B circuits. Last the response times of the different functions are measured and verified as to their specifications.

5.4.1 Digital Control and Programming Performance Procedure

1. Remove the following plug-in PCB assemblies from the Mother Boards.

   Sign and Over Voltage (B) A1
   Sign and Over Voltage (A) A2
   Power Amplifier and Over Current (B) A3
   Power Amplifier and Over Current (A) A4
   Digital to Analog Converter (B) A5
   Digital to Analog Converter (A) A6

The remaining three plug-in PCB's A7, A8 and A9 allows for the operational testing of the local and remote programming, as verified by the readout on the A9 assembly (the only exception is the programming of the Over Current and Over Voltage functions, which must be checked at the A7 PCB edge connector). Extend the A7 PCB assembly with an extender board.

2. Apply power to the DPSD-50 and configure the panel switches as follows:

   MODE

   REMOTE/LOCAL to LOCAL
   SOURCE A/SOURCE B to SOURCE A

   +/- to +
   x1/x0.1 to x1
   OUTPUT VOLTAGE BCD switches to 1001 1001 1001 1001

Press the STROBE pushbutton switch and verify that the A PROGRAMMED VOLTS display indicates +99.99.

3. Configure the panel switches as follows:

   MODE

   REMOTE/LOCAL to LOCAL
   SOURCE A/SOURCE B to SOURCE A

   +/- to -
   x1/x0.1 to x0.1
   OUTPUT VOLTAGE BCD switches to 0110 0110 0110 0110

Press the STROBE pushbutton switch and verify that the A PROGRAMMED VOLTS display indicates -6.666.

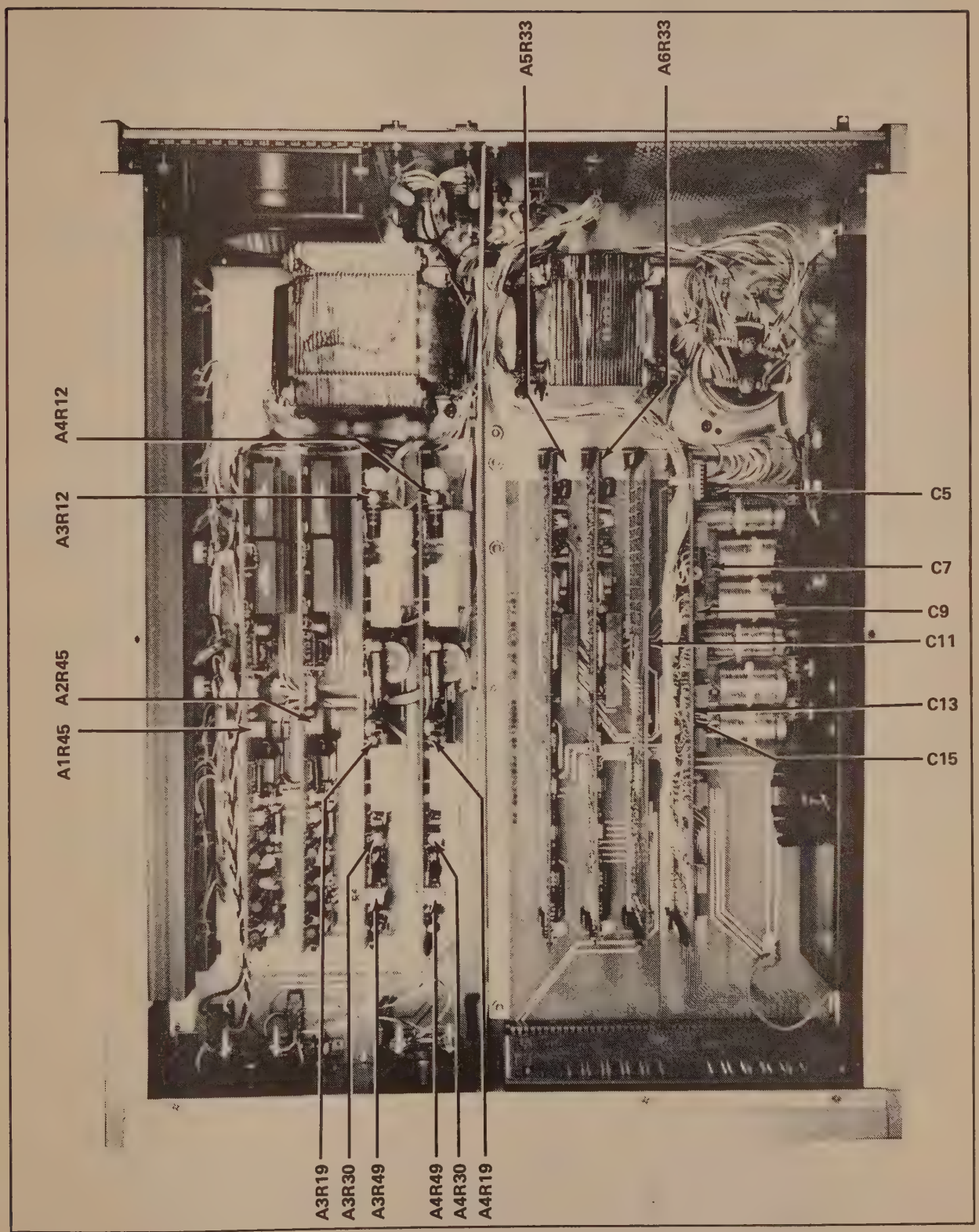


FIGURE 5-1 INTERNAL ADJUSTMENTS AND TEST POINTS

4. Configure the panel switches as follows:

```
MODE
  REMOTE/LOCAL  to  LOCAL
  SOURCE A/SOURCE B  to  SOURCE B
+/-  to  +
x1/x0.1  to  x1
OUTPUT VOLTAGE BCD switches to 1001 1001 1001 1001
```

Press the STROBE pushbutton switch and verify that the A PROGRAMMED VOLTS display indicates +99.99.

5. Configure the panel switches as follows:

```
MODE
  REMOTE/LOCAL  to  LOCAL
  SOURCE A/SOURCE B  to  SOURCE B
+/-  to  -
x1/x0.1  to  x0.1
OUTPUT VOLTAGE VCD switches to 0110 0110 0110 0110
```

Press the STROBE pushbutton switch and verify that the B PROGRAMMED VOLTS display indicates -6.666.

6. Configure the panel switches as follows:

```
MODE
  REMOTE/LOCAL  to  LOCAL
  SOURCE A/SOURCE B  to SOURCE A
OVER VOLTAGE BINARY switches to 1001
OVER CURRENT BINARY switches to 1001
```

Press the STROBE pushbutton switch and verify the digital levels on the following pins of the Digital Programming PCB A7 edge connector.

A7 Connector Pin No.	Signal Name	Logic State 0 = 0V 1 = +5V
15	Over Voltage (A) Bit 1	1
16	Over Voltage (A) Bit 2	0
17	Over Voltage (A) Bit 4	0
18	Over Voltage (A) Bit 8	1
V	Over Current (A) Bit 1	1
T	Over Current (A) Bit 2	0
U	Over Current (A) Bit 4	0
S	Over Current (A) Bit 8	1

7. Configure the panel switches as follows:

```
MODE
  REMOTE/LOCAL  to   LOCAL
  SOURCE A/SOURCE B  to SOURCE A
OVER VOLTAGE BINARY switches to 0110
OVER CURRENT BINARY switches to 0110
```

Press the STROBE pushbutton switch and verify the digital levels on the following pins of the Digital Programming PCB A7 edge connector.

A7 Connector Pin No.	Signal Name	Logic State 0 = 0V 1 = +5V
15	Over Voltage (A) Bit 1	0
16	Over Voltage (A) Bit 2	1
17	Over Voltage (A) Bit 4	1
18	Over Voltage (A) Bit 8	0
V	Over Current (A) Bit 1	0
T	Over Current (A) Bit 2	1
U	Over Current (A) Bit 4	1
S	Over Current (A) Bit 8	0

8. Configure the panel switches as follows:

MODE
REMOTE/LOCAL to LOCAL
SOURCE A/SOURCE B to SOURCE B
OVER VOLTAGE BINARY switches to 1001
OVER CURRENT BINARY switches to 1001

Press the STROBE pushbutton switch and verify the digital levels on the following pins of the Digital Programming PCB A7 edge connector.

A7 Connector Pin No.	Signal Name	Logic State 0 = 0V 1 = +5V
19	Over Voltage (B) Bit 1	1
20	Over Voltage (B) Bit 2	0
21	Over Voltage (B) Bit 4	0
22	Over Voltage (B) Bit 8	1
Z	Over Current (B) Bit 1	1
X	Over Current (B) Bit 2	0
Y	Over Current (B) Bit 4	0
W	Over Current (B) Bit 8	1

9. Configure the panel switches as follows:

MODE
REMOTE/LOCAL to LOCAL
SOURCE A/SOURCE B to SOURCE B
OVER VOLTAGE BINARY to 0110
OVER CURRENT BINARY to 0110

Press the STROBE pushbutton switch and verify the digital levels on the following pins of the Digital Programming PCB A7 edge connector.

A7 Connector Pin No.	Signal Name	Logic State 0 = 0V 1 = +5V
19	Over Voltage (B) Bit 1	0
20	Over Voltage (B) Bit 2	1
21	Over Voltage (B) Bit 4	1
22	Over Voltage (B) Bit 8	0
Z	Over Current (B) Bit 1	0
X	Over Current (B) Bit 2	1
Y	Over Current (B) Bit 4	1
W	Over Current (B) Bit 8	0

10. Configure the panel switches as follows:

MODE
REMOTE/LOCAL to REMOTE
SOURCE A/SOURCE B to SOURCE A
A ADDRESS B Binary switches to 10101 10101

Program the following DIGITAL INTERFACE rear panel connector data lines as indicated below (logic 1 to Digital Gnd pins 43,44,45 and 50, logic 0 no connection +5V).

Digital Interface Connector Pin No.	Signal Name	Logic States 1 = Digital Gnd 0 = NC (+5V)
21	Address Bit 1	1
20	Address Bit 2	0
19	Address Bit 4	1
18	Address Bit 8	0
17	Address Bit 16	1
23	Function Bit 1	1
22	Function Bit 2	1
4	Data MSD Bit 1	1
3	Data MSD Bit 2	1

Enter the above data by generating a Remote Strobe (momentarily placing the Digital Interface Connector pin 25 External Strobe to Digital Gnd pin 50). Program the following DIGITAL INTERFACE rear panel data lines to the following states:

Digital Interface Connector Pin No.	Signal Name	Logic State 1 = Digital Gnd 0 = NC (+5V)
21	Address Bit 1	1
20	Address Bit 2	0
19	Address Bit 4	1
18	Address Bit 8	0
17	Address Bit 16	1
23	Function Bit 1	0
22	Function Bit 2	0
4	Data MSD Bit 1	1
3	Data MSD Bit 2	0
2	Data MSD Bit 4	0
1	Data MSD Bit 8	1

Digital Interface Connector Pin No.	Signal Name	Logic State 1 = Digital Gnd 0 = NC (+5V)
8	Data NMSD Bit 1	1
7	Data NMSD Bit 2	0
6	Data NMSD Bit 4	0
5	Data NMSD Bit 8	1
12	Data NLSD Bit 1	1
11	Data NLSD Bit 2	0
10	Data NLSD Bit 4	0
9	Data NLSD Bit 8	1
16	Data LSD Bit 1	1
15	Data LSD Bit 2	0
14	Data LSD Bit 4	0
13	Data LSD Bit 8	1

Enter the above data by generating a Remote Strobe (momentarily placing the DIGITAL INTERFACE Connector pin 25 External Strobe to pin 50 Digital Gnd). Verify that the A PROGRAMMED VOLTS display indicates +99.99.

11. Configure the panel switches as follows:

MODE
REMOTE/LOCAL to REMOTE
SOURCE A/SOURCE B to SOURCE B
A ADDRESS B to 10101 10101

Program the following DIGITAL INTERFACE data lines to the following states:

Digital Interface Connector Pin No.	Signal Name	Logic States 1 = Digital Gnd 0 = NC (+5V)
21	Address Bit 1	1
20	Address Bit 2	0
19	Address Bit 4	1
18	Address Bit 8	0
17	Address Bit 16	1
23	Function Bit 1	0
22	Function Bit 2	1
4	Data MSD Bit 1	1
3	Data MSD Bit 2	0
2	Data MSD Bit 4	1
1	Data MSD Bit 8	0

Enter the above data by generating a Remote Strobe (momentarily placing the DIGITAL INTERFACE connector pin 25 to Digital Gnd pin 50). Reprogram the following DIGITAL INTERFACE connector data lines as follows:

Digital Interface Connector Pin No.	Signal Name	Logic States 1 = Digital Gnd 0 = NC (+5V)
22	Function Bit 1	0
23	Function Bit 2	1

Enter the above data by generating a Remote Strobe. Verify the digital levels on the following pins of the Digital Programming PCB A7 edge connector.

A7 Connector Pin No.	Signal Name	Logic State 0 = 0V 1 = +5V
15	Over Voltage (A) Bit 1	1
16	Over Voltage (A) Bit 2	0
17	Over Voltage (A) Bit 4	1
18	Over Voltage (A) Bit 8	0
V	Over Current (A) Bit 1	1
T	Over Current (A) Bit 2	0
U	Over Current (A) Bit 4	1
S	Over Current (A) Bit 8	0

12. Configure the panel switches as follows:

MODE
REMOTE/LOCAL to REMOTE
SOURCE A/SOURCE B to SOURCE B
A ADDRESS B Binary switches to 01010 01010

Program the following DIGITAL INTERFACE rear panel connector data lines as follows:

Digital Interface Connector Pin No.	Signal Name	Logic States 1 = Digital Gnd 0 = NC (+5V)
21	Address Bit 1	0
20	Address Bit 2	1
19	Address Bit 4	0
18	Address Bit 8	1
17	Address Bit 16	0
23	Function Bit 1	1
22	Function Bit 2	1
4	Data MSD Bit 1	0
3	Data MSD Bit 2	0

Enter the above data by generating a Remote Strobe (momentarily placing the DIGITAL INTERFACE connector pin 25 External Strobe to Digital Gnd pin 50). Program the following DIGITAL INTERFACE rear panel lines to the following states.

Digital Interface Connector Pin No.	Signal Name	Logic States 1 = Digital Gnd 0 = NC (+5V)
21	Address Bit 1	0
20	Address Bit 2	1
19	Address Bit 4	0
18	Address Bit 8	1
17	Address Bit 16	0
22	Function Bit 1	0
23	Function Bit 2	0
4	Data MSD Bit 1	0
3	Data MSD Bit 2	1

Digital Interface Connector Pin No.	Signal Name	Logic States 1 = Digital Gnd 0 = NC (+5V)
2	Data MSD Bit 4	1
1	Data MSD Bit 8	0
8	Data NMSD Bit 1	0
7	Data NMSD Bit 2	1
6	Data NMSD Bit 4	1
5	Data NMSD Bit 8	0
12	Data NLSD Bit 1	0
11	Data NLSD Bit 2	1
10	Data NLSD Bit 4	1
9	Data NLSD Bit 8	0
16	Data LSD Bit 1	0
15	Data LSD Bit 2	1
14	Data LSD Bit 4	1
13	Data LSD Bit 8	0

Enter the above data by generating a Remote Strobe. Verify that the B PROGRAMMED VOLTS display indicates -6.666.

13. Configure the panel switches as follows:

MODE
REMOTE/LOCAL to REMOTE
SOURCE A/SOURCE B to SOURCE B
A ADDRESS B to 01010 01010

Program the following DIGITAL INTERFACE connector data lines to the following states:

Digital Interface Connector Pin No.	Signal Name	Logic States 1 = Digital Gnd 0 = N (+5V)
21	Address Bit 1	0
20	Address Bit 2	1
19	Address Bit 4	0
18	Address Bit 8	1
17	Address Bit 16	0
23	Function Bit 1	0
22	Function Bit 2	1
4	Data MSD Bit 1	0
3	Data MSD Bit 2	1
2	Data MSD Bit 4	0
1	Data MSD Bit 8	1

Enter the above data by generating a Remote Strobe. Reprogram the following DIGITAL INTERFACE connector data lines as follows:

Digital Connector Pin No.	Signal Name	Logic States 1 = Digital Gnd 0 = NC (+5V)
23	Function Bit 1	0
22	Function Bit 2	1

Enter the above data by generating a Remote Strobe. Verify the levels on the following pins of the Digital Programming PCB A7 edge connector.

A7 Connector Pin No.	Signal Name	Logic States 0 = 0V 1 = +5V
19	Over Voltage Bit 1	0
20	Over Voltage Bit 2	1
21	Over Voltage Bit 4	0
22	Over Voltage Bit 8	1
Z	Over Current Bit 1	0
X	Over Current Bit 2	1
Y	Over Current Bit 4	0
W	Over Current Bit 8	1

14. Remove the A7 PCB Assembly from its extender board and reinstall it into the Mother Board. Install the Digital-to-Analog (A) A6 and the Digital-to-Analog (B) PCB A5 with extender boards into their appropriate Mother Board connections.

15. Configure the panel switches as follows:

MODE
REMOTE/LOCAL to LOCAL
SOURCE A/SOURCE B to SOURCE A
OUTPUT VOLTAGE BCD switches to 0000 0000 0000 0000

Press the STROBE pushbutton switch. With a DMM measure the voltage on the pin 5 of IC's A6U1 through A6U16 and verify that they are at a logic low state (≤0.5 Vdc). This test measured the saturation voltage of the OUTPUT VOLTAGE (A) SOURCE data "opto-isolators".

16. Configure the panel switches as follows:

MODE
REMOTE/LOCAL to LOCAL
SOURCE A/SOURCE B to SOURCE A
OURPUT VOLTAGE BCD switches to 1111 1111 1111 1111

Press the STROBE pushbutton switch. With a DDM measure the voltage on the pin 5 of IC's A6U1 through A6U16 and verify they are at a logic high state (≥4.5 Vdc).

17. Configure the panel switches as follows:

MODE
REMOTE/LOCAL to LOCAL
SOURCE A/SOURCE B to SOURCE B
OUTPUT VOLTAGE BCD switches to 0000 0000 0000 0000

Press the STROBE pushbutton switch. With a DDM measure the voltage on pin 5 of IC's A5U1 through A5U16 and verify that they are at a logic low state (≤0.5 Vdc).

18. Configure the panel switches as follows:

MODE
REMOTE/LOCAL to LOCAL
SOURCE A/SOURCE B to SOURCE B
OUTPUT VOLTAGE BCD switches to 1111 1111 1111 1111

Press the STROBE pushbutton switch. With a DDM measure the voltage on pin 5 of IC's A5U1 through A5U16 and verify that they are at a logic high state (≥4.5 Vdc).

19. Remove the A5 and A6 PCB Assemblies from their extender boards and reinstall them into the Mother Board connectors.

5.4.2 Source A Analog Circuits Performance Test and Calibration Procedure

1. Install the Power Amplifier (A) PCB A4 and the Sign and Over Voltage (A) PCB A2 into their appropriate Analog Mother Board connectors. Install a jumper from the cathode to the gate lead of the Source A Over Voltage SCR (CR15) located on the left gusset Heatsink Assembly.

NOTE

The Over Voltage SCR must be disabled when performance tests and alignments on the over current and current regulation circuits are performed. If the Over Voltage circuit tripped when the current regulation circuits were malfuncting or out of calibration, burn out of the series pass regulator transistors may result.

2. Ensure that the shorting links are installed between the SOURCE A V OUT and S OUT terminals and the V RET and S RET terminals located on the rear panel terminal barrier strip (local sense configuration).

3. Configure the panel switches as follows:

MODE
SOURCE A/SOURCE B to SOURCE A
LOCAL/REMOTE to LOCAL
+/- to +
x1/x0.1 to x1
OUTPUT VOLTAGE BCD switches to 0000 0000 0000 0000
OVER VOLTAGE BINARY switches to 1111
OVER CURRENT BINARY switches to 1111

Press the STROBE pushbutton switch.

4. Connect a DMM across the rear panel SOURCE A V OUT and V RET terminals, to monitor the output voltage. Adjust the front panel A ZERO ADJUST control for a 0 volt ±100 µV indication on the DMM.

5. Reprogram the OUTPUT VOLTAGE BCD switches to 0101 0000 0000 0000 (50.00 volts) and press the STROBE pushbutton switch. Adjust the front panel A FULL SCALE ADJUST for a 50 volt ±1 mV indication on the DDM.

6. Repeat the adjustments of the A ZERO ADJUST and the A FULL SCALE ADJUST.

7. Place the x1/x0.1 switch to the x0.1 position. Reconfigure the OUTPUT VOLTAGE BCD switches to 1001 1001 1001 1001 and press the STROBE pushbutton switch. Verify that the A PROGRAMMED VOLTS display indicates +9.999. Adjust potentiometer A6R33 for a DMM reading at the Source A output terminals of +9.999 V ±100 µV.

8. Reconfigure the output voltage for zero volts, then adjust potentiometer A4R19 (COMP) and A ADJUST control while alternately programming the range from x1 to x0.1 for a DMM Source A output of as close to 0 volts as possible (+1 to 0 mV on the x1 range and ±100 µV on the x0.1 range).

9. Repeat steps 3 through 8 to ensure that Source A voltage is adjusted correctly.

10. Configure the panel switches as follows:

MODE
SOURCE A/SOURCE B to SOURCE A
LOCAL/REMOTE to LOCAL
+/- to +
x1/x0.1 to x1
OUTPUT VOLTAGE BCD switches to 0101 0000 0000 0000

Press the STROBE pushbutton switch and verify that the A PROGRAMMED VOLTS display indicates +50.00. Place the METER SOURCE selector to A.

11. Connect a DMM set to its current function in series with a variable load resistor across the SOURCE A V OUT and V RET rear panel terminals. Adjust the load resistor for a 1.00 ampere indication on the DMM. Adjust potentiometer A4R12 (AMMETER) for a front panel DC AMPERES meter reading of 1.0A.

12. Set potentiometer A4R43 (OVER CURRENT) to its mid position. Adjust the load resistor until the DMM reads 1.20A, then adjust potentiometer A4R43 to reduce the current to 1.10 amperes as indicated on the DMM.

13. Adjust the load resistor to reduce the current below 1 ampere, then slowly increase the load and verify that it limits at 1.10 amperes and that the front panel SOURCE A OVER CURRENT lamp illuminates.

14. Program all 16 steps of the Over Current and verify that the source current limits at its correct value (±5%) as indicated in the following table.

Over Current Switch BCD Setting	Current Limiting Level in Amperes ±5%
0000	0.03
0001	0.11
0010	0.18
0011	0.25
0100	0.32
0101	0.39
0110	0.47
0111	0.54
1000	0.62
1001	0.69
1010	0.75
1011	0.82
1100	0.89
1101	0.96
1110	1.03
1111	1.10

15. Configure the panel switches as follows:

MODE
LOCAL/REMOTE to LOCAL
SOURCE A/SOURCE B to SOURCE A
+/- to +
x1/x0.1 to x1
OUTPUT VOLTAGE BCD switches to 0101 0000 0000 0000

Press the STROBE pushbutton switch. Adjust the load resistor for a 1.00 ampere load, and verify an output of +50.00V on a DMM connected across the SOURCE A outputs. Switch the polarity switch from + to -, press the STROBE Pushbutton switch and verify an output of -50.00V on the DMM.

16. Remove the jumper from the cathode to the gate lead on the Source A Over Voltage SCR (CR15) located on the left gusset heat sink. Remove the variable load resistor and the series connected DMM from the Source A output terminals.

17. Set potentiometer A2R45 to its mid range. Configure the panel switches as follows:

MODE
  LOCAL/REMOTE to LOCAL
  SOURCE A/SOURCE B to SOURCE A
+/- to +
x1/x0.1 to x1
OVER VOLTAGE BINARY switches to 1111
OUTPUT VOLTAGE BCD switches to 0101 0110 0000 0000

Press the STROBE pushbutton switch and verify that the Source A output voltage is +56.00V.

18. Slowly adjust potentiometer A2R45 CW until the Over Voltage circuit trips (as indicated by a 0 volt Source A output).

19. Program all 16 steps of the Over Voltage and verify that the trip points are at their correct levels (±5%) as indicated in the following table.

Over Voltage Switch BCD Setting	Over Voltage Trip Level in Volts ±5%
0000	5.2
0001	8.6
0010	11.9
0011	15.3
0100	18.8
0101	22.2
0110	25.6
0111	29.0
1000	32.4
1001	35.8
1010	39.1
1011	42.5
1100	46.0
1101	49.4
1110	52.8
1111	56.0

NOTE

To reset the Over Voltage circuit the output voltage must be programmed to 0 volts, then to the desired output voltage.

5.4.3 Source B Analog Circuits Performance Test and Calibration Procedure

1. Install the Power Amplifier (B) PCB A3 and the Sign and Over Voltage (B) PCB A1 into their appropriate Analog Mother Board connectors. Install a jumper from the cathode to the gate lead of the Source B Over Voltage SCR (CR16) located on the Left Gusset Heat Sink Assembly.

NOTE

The Over Voltage SCR must be disabled when performance tests and alignments on the over current and current regulation circuits are performed. If the Over Voltage circuit tripped when the current regulation circuits were malfunctting or out of calibration, burn out of the series pass regulator transistors may result.

2. Ensure that the storting links are installed between the SOURCE B V OUT and S OUT terminals and the V RET and S RET terminals located on the rear panel terminal barrier strip (local sense configuration).

3. Configure the panel switches as follows:

MODE
SOURCE A/SOURCE B to SOURCE B
LOCAL/REMOTE to LOCAL
+/- to +
x1/x0.1 to x1
OUTPUT VOLTAGE BCD switches to 0000 0000 0000 0000
OVER VOLTAGE BINARY switches to 1111
OVER CURRENT BINARY switches to 1111

Press the STROBE pushbutton switch.

4. Connect an DMM across the rear panel SOURCE B V OUT and V RET terminals, to monitor the output voltage. Adjust the front panel B ZERO ADJUST control for a 0 volt ±100 µV indication on the DMM.

5. Reprogram the OUTPUT VOLTAGE BCD swithces to 0101 0000 0000 0000 (50.00V) and press the STROBE pushbutton switch. Adjust the front panel B FULL SCALE ADJUST for a 50 volt ±1 mV indication on the DMM.

6. Repeat the adjustments of the B ZERO ADJUST and the B FULL SCALE ADJUST.

7. Place the x1/x0.1 switch to the x0.1 position. Reconfigure the OUTPUT VOLTAGE BCD switches to 1001 1001 1001 1001 and press the STROBE pushbutton switch. Verify that the B PROGRAMMED VOLTS display indicates +9.999. Adjust potentiometer A5R33 for a DMM reading at the Source B output terminals of +9.999V ±100 µV.

8. Reconfigure the output voltage for zero volts, then adjust potentiometer A3R19 (COMP) and B ADJUST control while alternately programming the range from x1 to x0.1 for a DMM Source B output of as close to 0 volts as possible (+1 to 0 mV on the x1 range and ±100 µV on the x0.1 range).

9. Repeat steps 3 through 8 to ensure that Source B voltage is adjusted correctly.

10. Configure the panel switches as follows:

MODE
SOURCE A/SOURCE B to SOURCE B
LOCAL/REMOTE to LOCAL
+/- to +
x1/x0.1 to x1
OUTPUT VOLTAGE BCD switches to 0101 0000 0000 0000

Press the STROBE pushbutton switch and verify that the B PROGRAMMED VOLTS display indicates +50.00 V. Place the METER SOURCE selector to B.

11. Connect a DMM set to its current function in series with a variable load resistor across the SOURCE B V OUT and V RET rear panel terminals. Adjust the load resistor for a 1.00 ampere indication on the DMM. Adjust potentiometer A3R12 (AMMETER) for a front panel DC AMPERES meter reading of 1.0A.

12. Set potentiometer A3R43 (OVER CURRENT) to its mid position. Adjust the load resistor until the DMM reads 1.20A, then adjust potentiometer A3R43 to reduce the current to 1.10 amperes as indicated on the DMM.

13. Adjust the load resistor to reduce the current below 1 ampere, then slowly increase the load and verify that it limits at 1.10 amperes and that the front panel SOURCE B OVER CURRENT lamp illuminates.

14. Program all 16 steps of the Over Current and verify that the source current limits at its correct value (±5%) as indicated in the following table.

Over Current Switch BCD Setting	Current Limiting Level in Amperes ±5%
0000	0.03
0001	0.11
0010	0.18
0011	0.25
0100	0.32
0101	0.39
0110	0.47
0111	0.54
1000	0.62
1001	0.69
1010	0.75
1011	0.82
1100	0.89
1101	0.96
1110	1.03
1111	1.10

15. Configure the panel switches as follows:

MODE
LOCAL/REMOTE to LOCAL
SOURCE A/SOURCE B to SOURCE B
+/- to +
x1/x0.1 to x1
OUTPUT VOLTAGE BCD switches to 0101 0000 0000 0000

Press the STROBE pushbutton switch. Adjust the load resistor for a 1.00 ampere load, and verify a output of +50.00V on a DMM connected across the SOURCE B outputs. Switch the polarity switch from + to -, press the STROBE pushbutton switch and verify an output of -50.00V on the DMM.

16. Remove the jumper from the cathode to the gate lead on the Source B Over Voltage SCR (CR16) located on the Left Gusset Heat Sink. Remove the variable load resistor and the series connected DMM from the Source B output terminals.

17. Set potentiometer A1R45 to its mid range. Configure the panel switches as follows:

MODE
  LOCAL/REMOTE to LOCAL
  SOURCE A/SOURCE B to SOURCE B
+/- to +
x1/x0.1 to x1
OVER VOLTAGE BINARY switches to 1111
OUTPUT VOLTAGE BCD switches to 0101 0110 0000 0000

Press the STROBE pushbutton switch and verify that the Source B output voltage is +56.00V.

18. Slowly adjust potentiometer A1R45 CW until the Over Voltage circuit trips (as indicated by a 0 volt Source B output.

19. Program all 16 steps of the Over Voltage and verify that the trip points are at their correct levels (±5%) as indicated in the following table.

Over Voltage Switch BCD Setting	Over Voltage Trip Level in Volts ±5%
0000	5.2
0001	8.6
0010	11.9
0011	15.3
0100	18.8
0101	22.2
0110	25.6
0111	29.0
1000	32.4
1001	35.8
1010	39.1
1011	42.5
1100	46.0
1101	49.4
1110	52.8
1111	56.0

NOTE

To reset the Over Voltage circuit the output voltage must be programmed to 0 volts, then to the desired output voltage.

5.4.4 Source A Response Time Performance Tests

1. Install a variable load resistor across the SOURCE A rear panel V OUT and V RET terminals. Ensure that the output terminals are straped for local sensing and V RET to GND.

2. Program the SOURCE A to a +50.00 volt output and adjust the variable load resistor for a 1.0 ampere load as indicated on the front panel DC AMPERE meter.

3. Sync an Oscilloscope to the LOCAL STROBE line at A8 PCB Assembly edge connector pin 20.

4. Alternately program the SOURCE A output voltage between +50.00 and +10.00 volts while monitoring the Source A output with the Oscilloscope. Verify that the response time is ≤1.5 ms (time period between the strobe generation and when the output voltage reaches 90% of its programmed level).

5. Remove the variable load resistor from across the Source A output terminals and connect a 250 μFd 65 WVDC electrolitic capacitor, with its + lead to the V OUT and its - lead to the V RET terminals. Alternately program the output voltage between +50.00 and +10.00 volts while monitoring the Oscilloscope. Verify that the output voltage goes from +10V to 49V in ≤12 ms and falls from +50V to +11V in ≤18 ms.

6. Remove the 250 μFd electrolitic capacitor from across the Source A terminals and reconnect the variable load resistor. Program the Source A to +50.00 volts then adjust the variable load resistor for a 1.0 ampere load. Place the Oscilloscope in its "chopped" mode and connect one of its inputs to the READY A FLAG at pin 24 of the rear panel DIGITAL INTERFACE connector and the other Oscilloscope input to the SOURCE A V OUT terminal.

7. Alternately program the Source A output voltage between +50.00 and +10.00 volts, while monitoring the Oscilloscope. Verify that the READY A FLAG goes to a 0V level when the Source A output voltage is ≈7 volts away from the previous programmed level and returns to a logic 1 (+5V) when the output voltage is within ≈7 volts of the current programmed level.

8. Place the range switch to its x0.1 position and alternately program the Source A output voltage between +5.000 and +1.000 volts, while monitoring the Oscilloscope. Verify that the READY A FLAG changes logic level when the output voltage deviates from the programmed voltage output by ≈0.7 volts.

5.4.5 Source B Response Time Performance Tests

1. Install a variable load resistor across the SOURCE B rear panel V OUT and V RET terminals. Ensure that the output terminals are straped for local sensing and V RET to GND.

2. Program the Source B to a +50.00 volt output and adjust the variable load resistor for a 1.0 ampere load as indicated on the front panel DC AMPERE meter.

3. Sync an Oscilloscope to the LOCAL STROBE line at A8 PCB Assembly edge connector pin 20 .

4. Alternately program the Source B output voltage between +50.00 and +10.00 volts while monitoring the Source B output with the Oscilloscope. Verify that the response time is ≤1.5 ms (time period between the strobe generation and when the output voltage reaches 90% of its programmed level).

5. Remove the variable load resistor from across the Source B output terminals and connect a 250 µFd 65 WVDC electrolitic capacitor, with its + lead to the V OUT and its - lead to the V RET terminals. Alternately program the output voltage between +50.00 and +10.00 volts while monitoring the Oscilloscope. Verify that the output voltage goes from +10V to 49V in ≤12 ms and falls from +50V to +11V in ≤18 ms.

6. Remove the 250 µFd electrolitic capacitor from acorss the Source B terminals and reconnect the variable load resistor. Program the Source B to +50.00 volts then adjust the variable load resistor for a 1.0 ampere load. Place the Oscilloscope in its "chopped" mode and connect one of its inputs to the READY B FLAG at pin 46 of the rear panel DIGITAL INTERFACE connector and the other Oscilloscope input to the SOURCE B V OUT terminal.

7. Alternately program the Source B output voltage between +50.00 and +10.00 volts, while monitoring the Oscilloscope. Verify that the READY B FLAG goes to a 0V level when the Source B output voltage is ≈7 volts away from the previous programmed level and returns to a logic 1(+5V) when the output voltage is within ≈7 volts of the current programmed level.

8. Place the range switch to its x0.1 position and alternately program the Source B output voltage between +5.000 and +1.000 volts, while monitoring the Oscilloscope. Verify that the READY B FLAG changes logic level when the output voltage deviates from the programmed voltage output by ≈0.7 volts.

5.4.6 Source Outputs, Ripple, Load and Line Effect Performance Tests

1. Program the Source output to be measured to +50.00 volts and load its output for 1 ampere with a variable load resistor.

2. Measure the output voltage ac components with an Oscilloscope and a DMM and verify that they are less than 0.5 mV rms as indicated on the DMM and less than 1.5 mV p-p as indicated on the Oscilloscope.

3. Program the Source output to be measured to +5.000 volts and load its output for a 1 ampere load.

4. Measure the output voltage ac components and verify that they are less than 0.3 mV rms and 0.75 mV p-p.

5. Program the Source output to be measured to +50.00 volts. Monitor the output voltage with a DMM while alternating the load from 1 ampere to no load. Verify that the output voltage variation is ≤500 µV.

6. Program the Source output to be measured to +50.00 volts and load it to 1 ampere.

7. Vary the ac line using a Metered Line Variac from 103 Vac to 127 Vac and verify that the Source output voltage changes less than 200 µVdc.

CHAPTER 6
DRAWINGS

6.1 INTRODUCTION

This chapter contains the schematic and component location diagrams for the Model DPSD-50 Digital Power Source. The Schematic Diagrams relate to the detailed circuit descriptions located in Chapter 4 of this manual. The parts lists contained in Chapter 7 relate to the reference designation call outs on the Schematic and Assembly diagrams. Table 6-1 provides a list by Figure number of the drawings, with Title, Systron-Donner drawing number and manual page number.

TABLE 6-1 LIST OF SCHEMATIC AND ASSEMBLY DRAWINGS

FIG. NO.	TITLE	S-D DWG. NO.	PAGE NO.
6-1	Power Supply Block Diagram Schematic (Sheet 1 of 3)	05597801B	6-3
6-1	Digital Block Diagram Schematic (Sheet 2 of 3)	05597801B	6-4
6-1	Analog Block Diagram Schematic (Sheet 3 of 3)	05597801B	6-5
6-2	A10, Digital Mother Board PC Assembly	05597001C	6-6
6-3	A11, Analog Mother Board PC Assembly	05597101B	6-7
6-4	A1/A2, Sine & Over Voltage PC Assembly	05590401B	6-8
6-5	A1/A2, Sine & Over Voltage Schematic	05590401C	6-9
6-6	A3/A4, Power Amp & Over Current PC Assembly	05593801D	6-10
6-7	A3/A4, Power Amp & Over Current Schematic	05593801C	6-11
6-8	A5/A6, Digital To Analog Converter PC Assembly	05596901E	6-12
6-9	A5/A6, Digital To Analog Converter Schematic	05596901E	6-13
6-10	A7, Digital Programming PC Assembly	05596801C	6-14
6-11	A7, Digital Programming Schematic	05596801C	6-15
6-12	A8, Digital Input PC Assembly	05596701B	6-16
6-13	A8, Digital Input Schematic	05596701B	6-17
6-14	A9, Control & Display PC Assembly	05593001C1	6-18
6-15	A9, Control & Display Schematic	05592001C	6-19
6-16	Option 01, IEEE-488 Input PC Assembly	05726301B	6-20
6-17	Option 01, IEEE-488 Input Schematic	05726301B	6-21
6-18	DPSD-50 Test Assembly (Sheet 1 of 3)	057097B1	6-22
6-18	DPSD-50 Test Assembly (Sheet 2 of 3)	057097B1	6-23
6-18	DPSD-50 Test Assembly (Sheet 3 of 3)	057097B1	6-24
6-19	Heat Sink Assembly	057090B	6-25
6-20	Right Side Assembly	057080A1	6-26
6-21	Rear Panel Assembly	057092B1	6-27

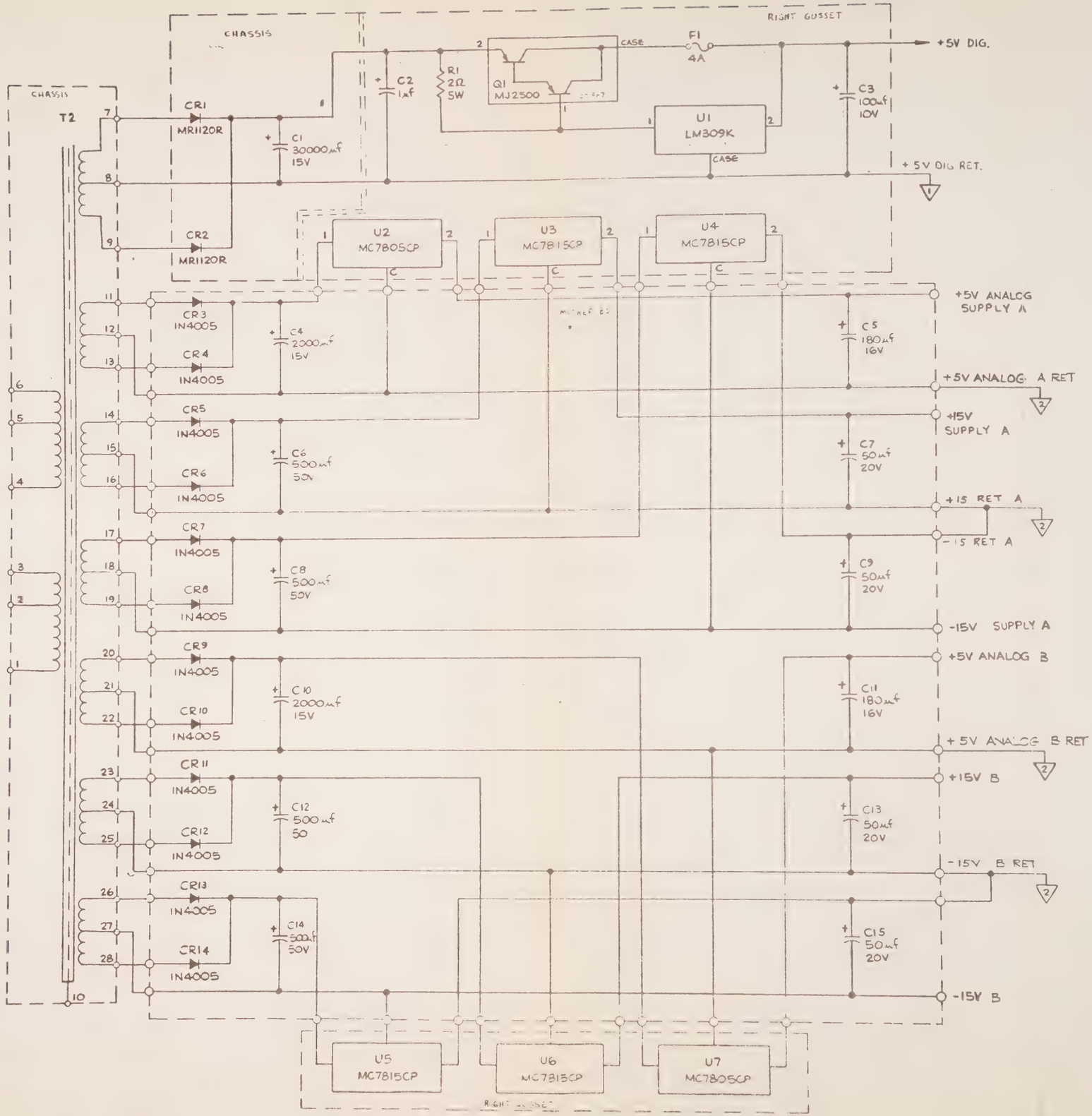


FIGURE 6-1 BLOCK DIAGRAM
POWER SUPPLY SCHEMATIC 05597801B
(Sheet 1 of 3)

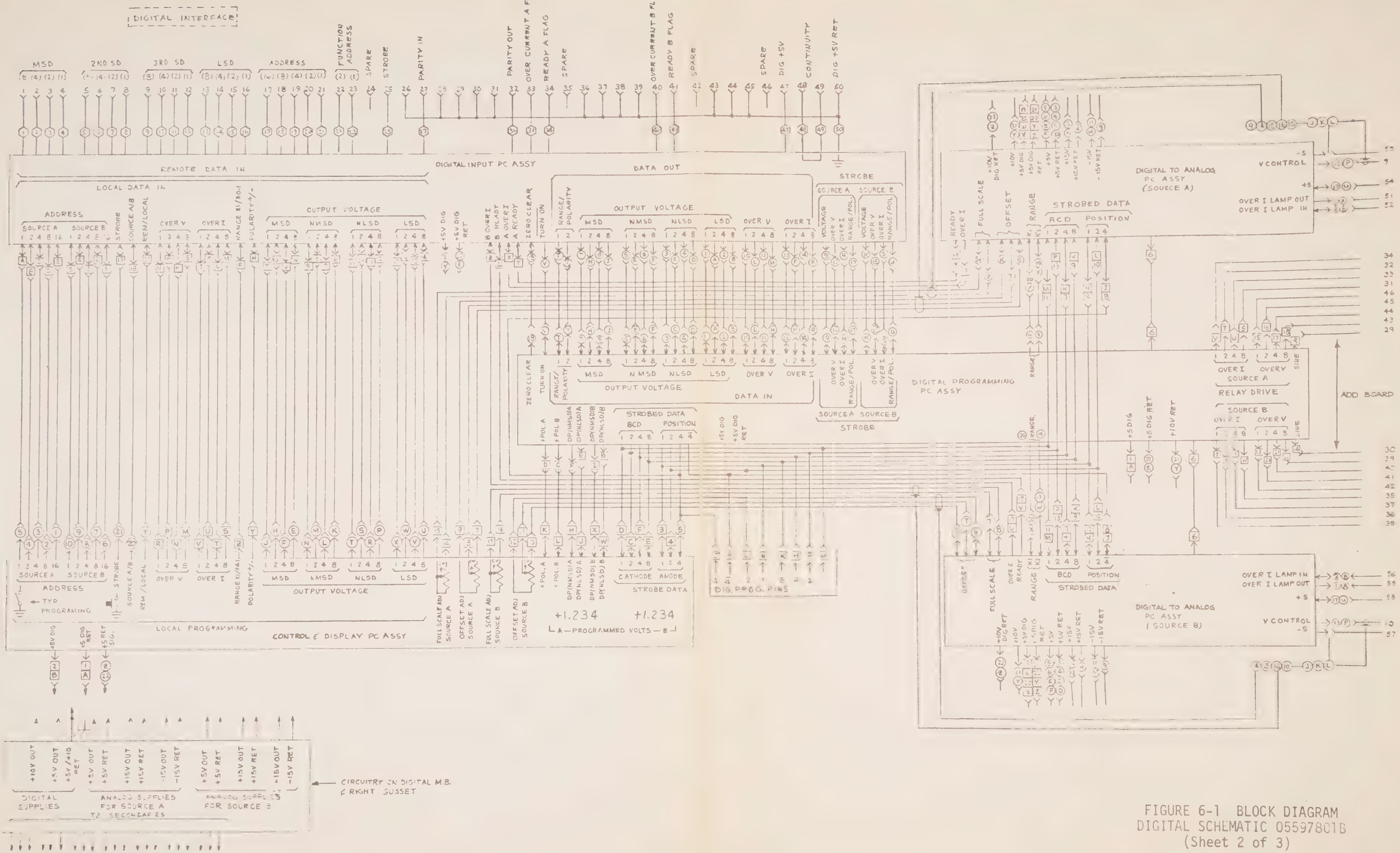


FIGURE 6-1 BLOCK DIAGRAM
DIGITAL SCHEMATIC 05597801B
(Sheet 2 of 3)

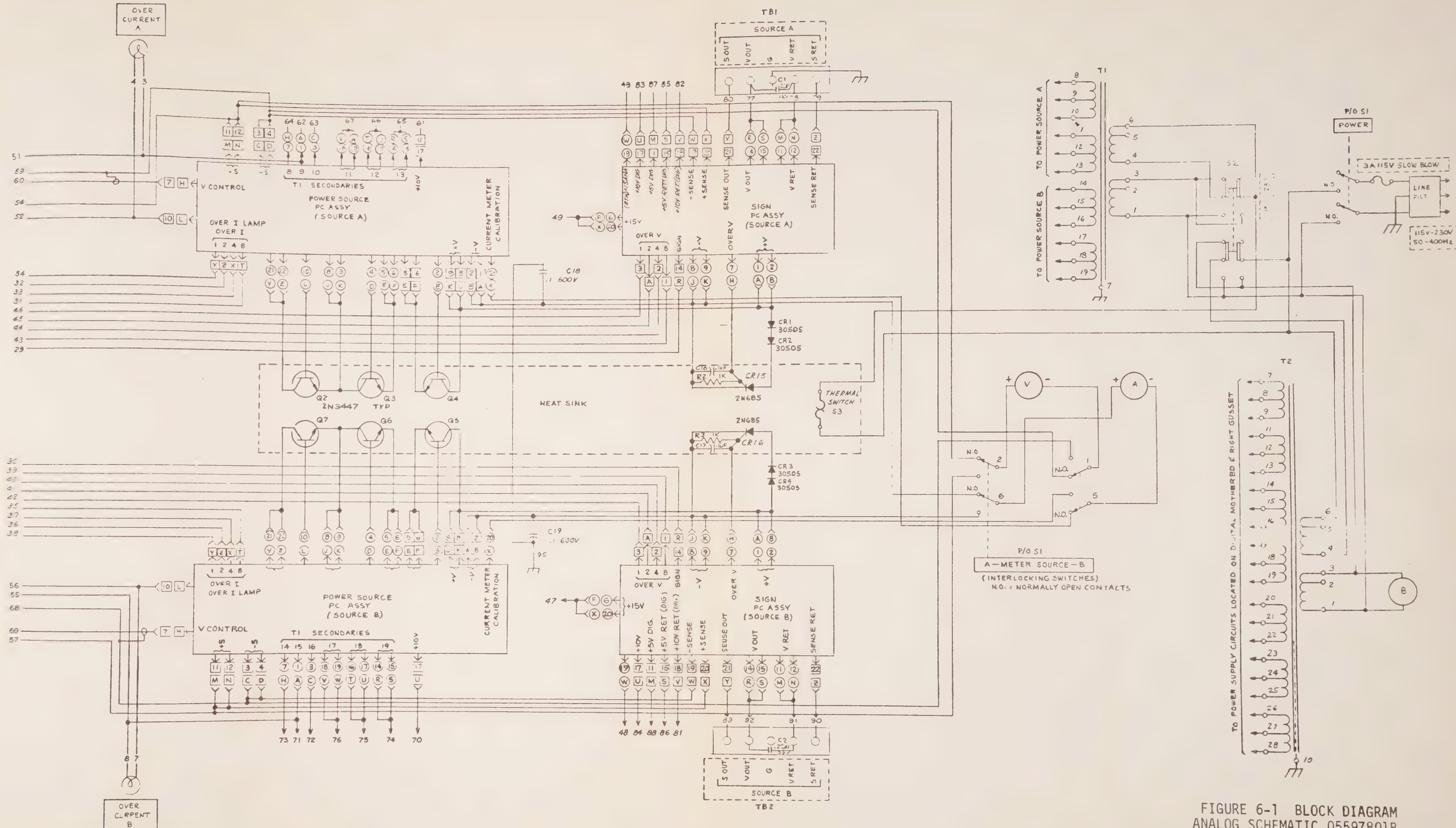


FIGURE 6-1 BLOCK DIAGRAM
ANALOG SCHEMATIC 05597801B
(Sheet 3 of 3)

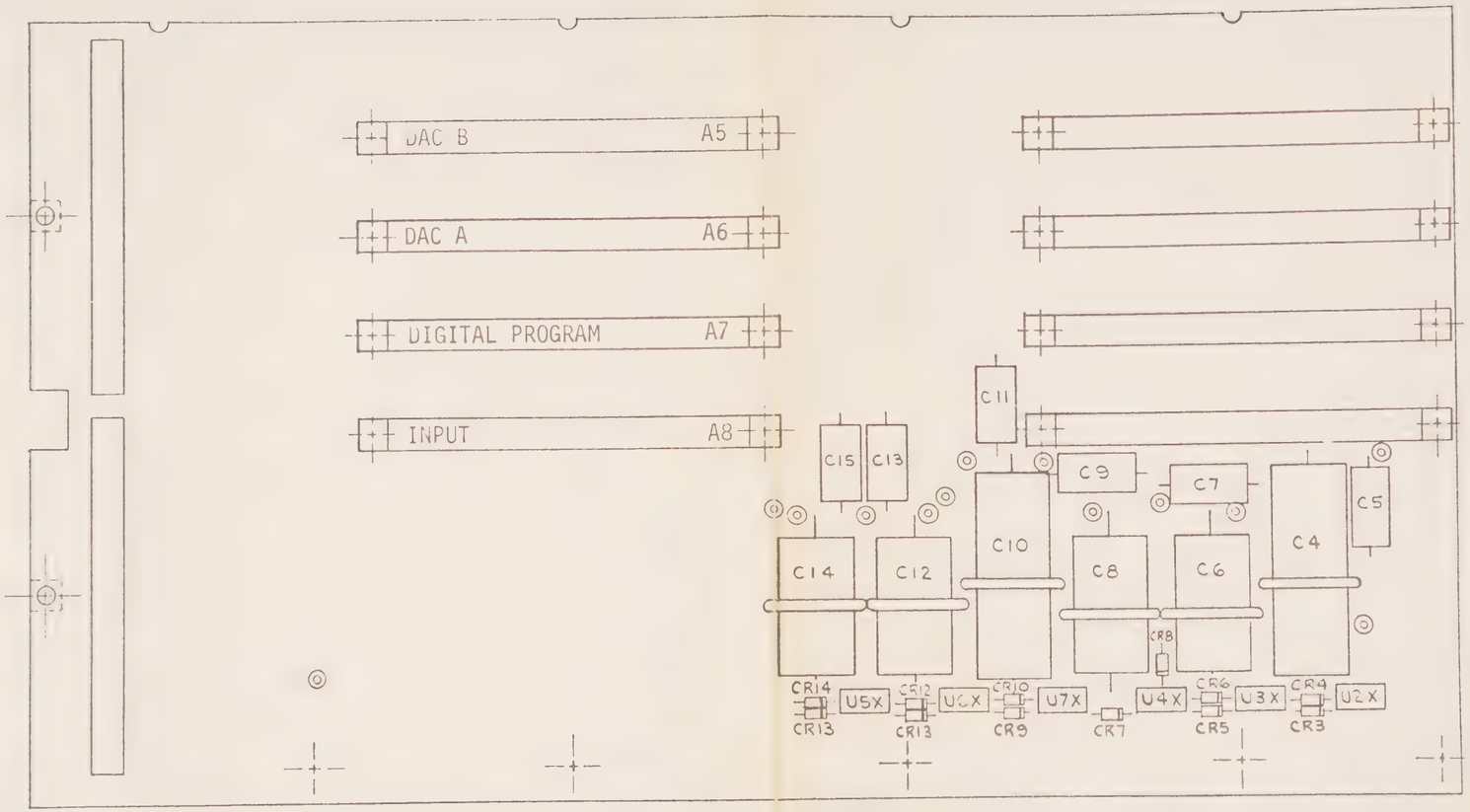


FIGURE 6-2 A10
DIGITAL MOTHER BOARD
PC ASSEMBLY 05597001C

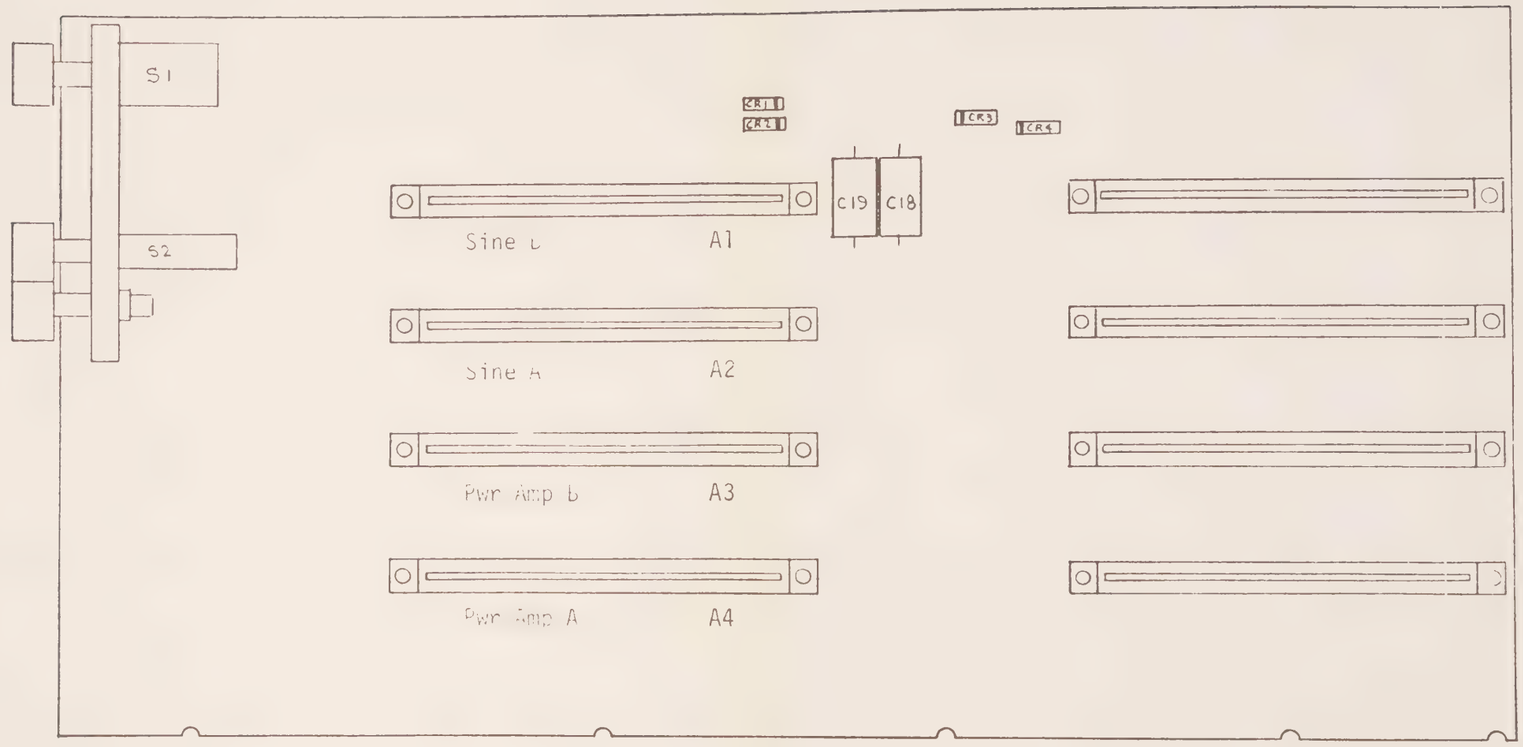


FIGURE 6-3 A11
ANALOG MOTHER BOARD
PC ASSEMBLY 05597101B

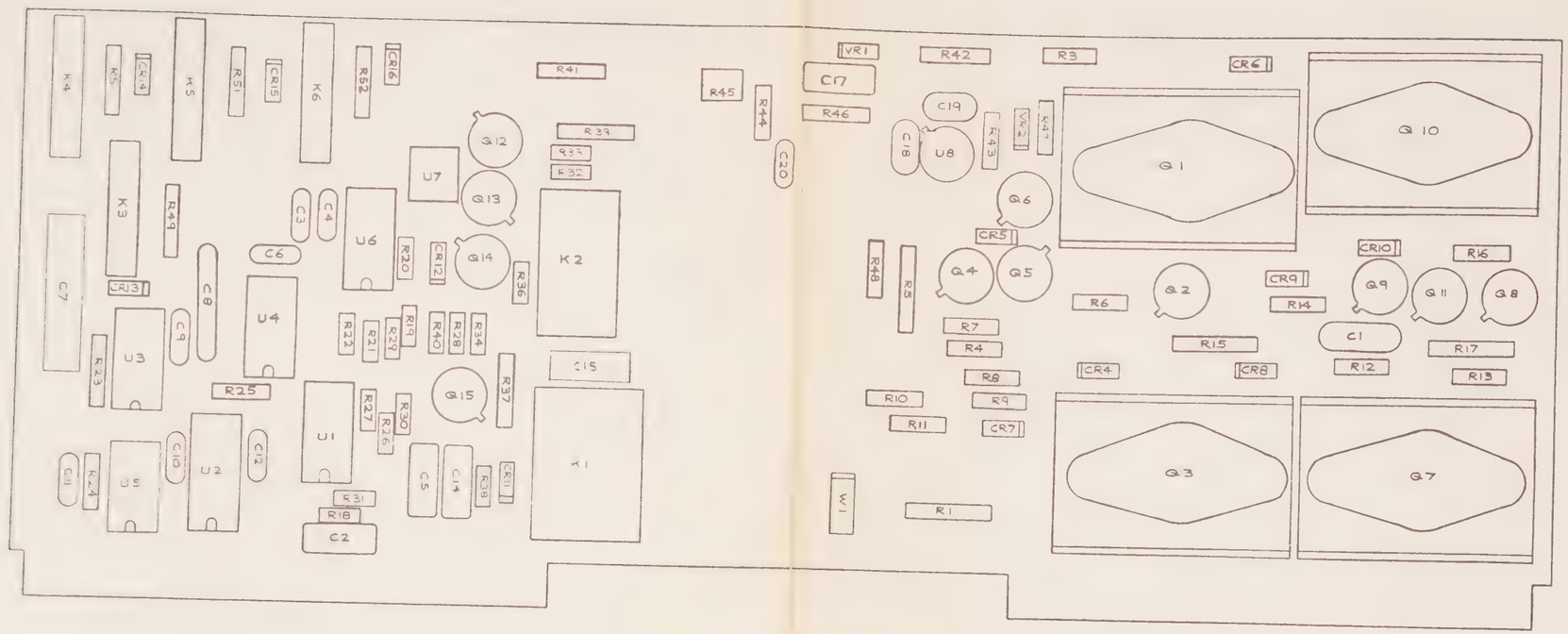
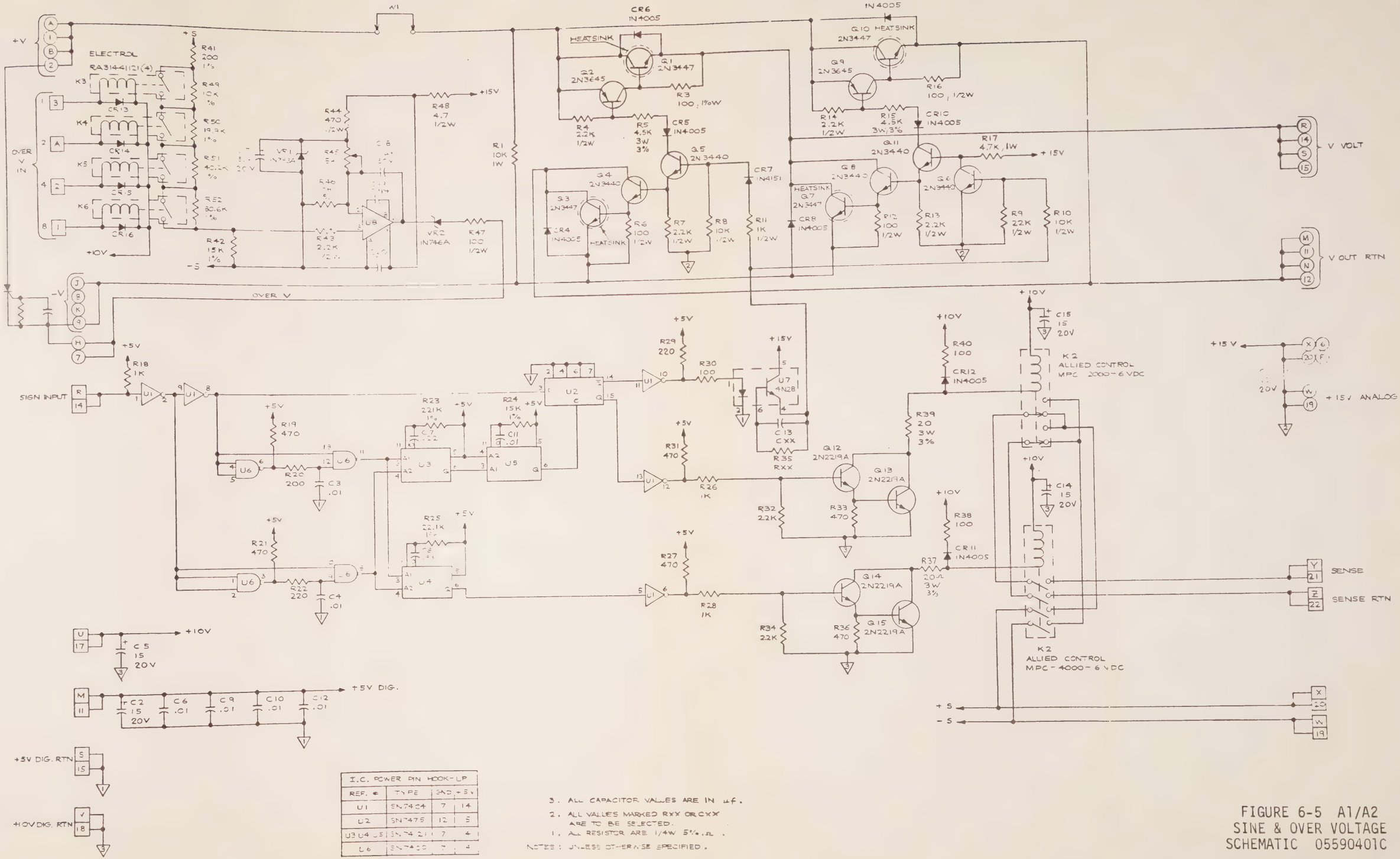


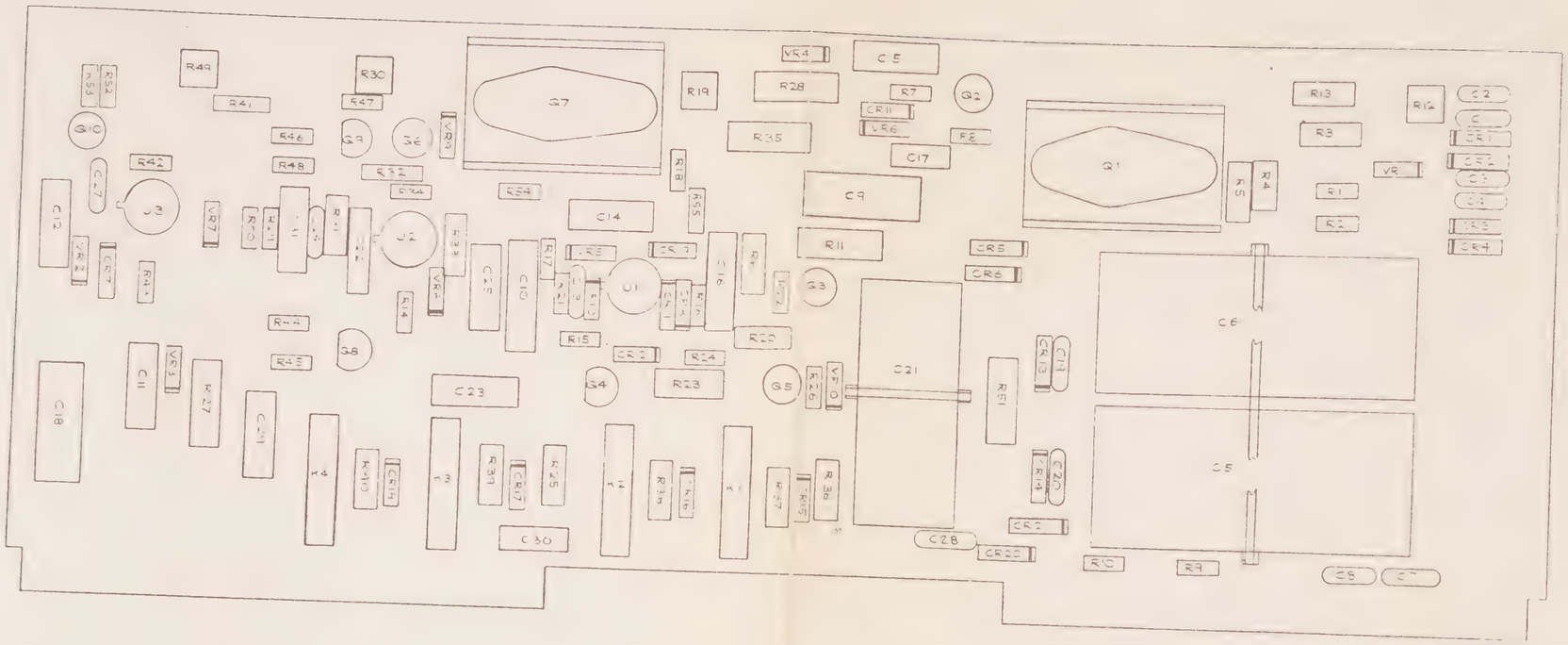
FIGURE 6-4 A1/A2
SINE & OVER VOLTAGE
PC ASSEMBLY 05590401B



I.C. POWER PIN HOOK-UP			
REF. #	TYPE	GND	+5V
U1	SN7404	7	14
U2	SN7475	12	5
U3 U4 U5	SN74 21	7	4
U6	SN7400	7	4

NOTES: UNLESS OTHERWISE SPECIFIED.
1. ALL RESISTOR ARE 1/4W 5%, Ω.
2. ALL VALUES MARKED RXX OR CXX ARE TO BE SELECTED.
3. ALL CAPACITOR VALUES ARE IN μf.

FIGURE 6-5 A1/A2
SINE & OVER VOLTAGE
SCHEMATIC 05590401C


R49
R41
R30
R47
R46
R48
R32
R54
R42
R52
R53
R34
R50
R51
R1
R2
R31
R14
R44
R45
R43
R40
R39
R38
R37
R36
R35
R28
R19
R18
R55
R17
R16
R15
R21
R22
R23
R24
R25
R26
R27
R29
R33
R12
R13
R3
R4
R5
R6
R7
R8
R9
R10
R11
VR1
VR2
VR3
VR4
VR5
VR6
VR7
CR1
CR2
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR10
CR11
CR12
CR13
CR14
CR15
CR16
CR17
CR18
CR19
CR20
CR21
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
C21
C22
C23
C24
C25
C26
C27
C28
C29
C30
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
U1
J1
J2
J3
J4
J5
J6
J7
J8
J9
J10
J11
J12
J13
J14
J15
J16
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J39
J40

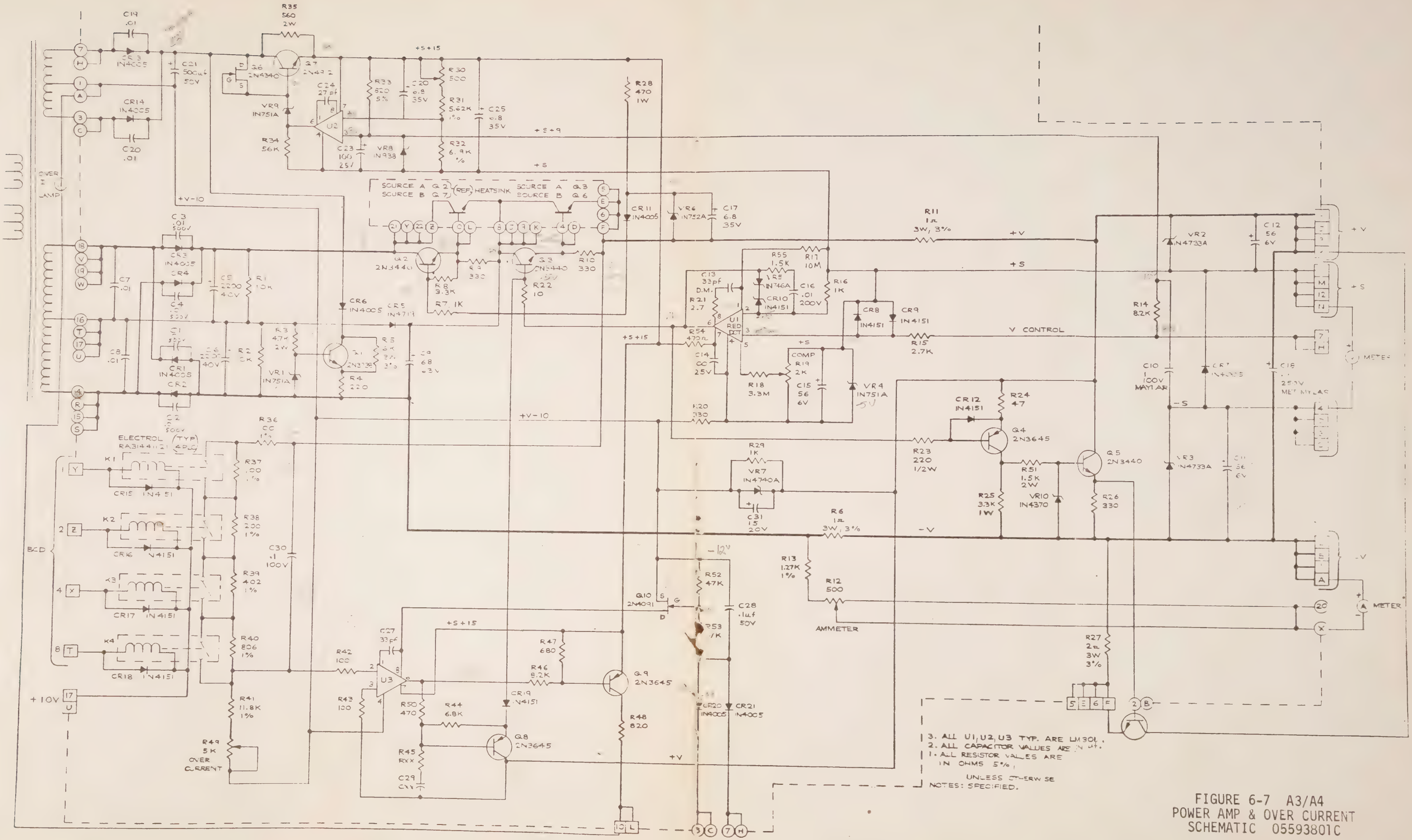


FIGURE 6-7 A3/A4
POWER AMP & OVER CURRENT
SCHEMATIC 05593801C

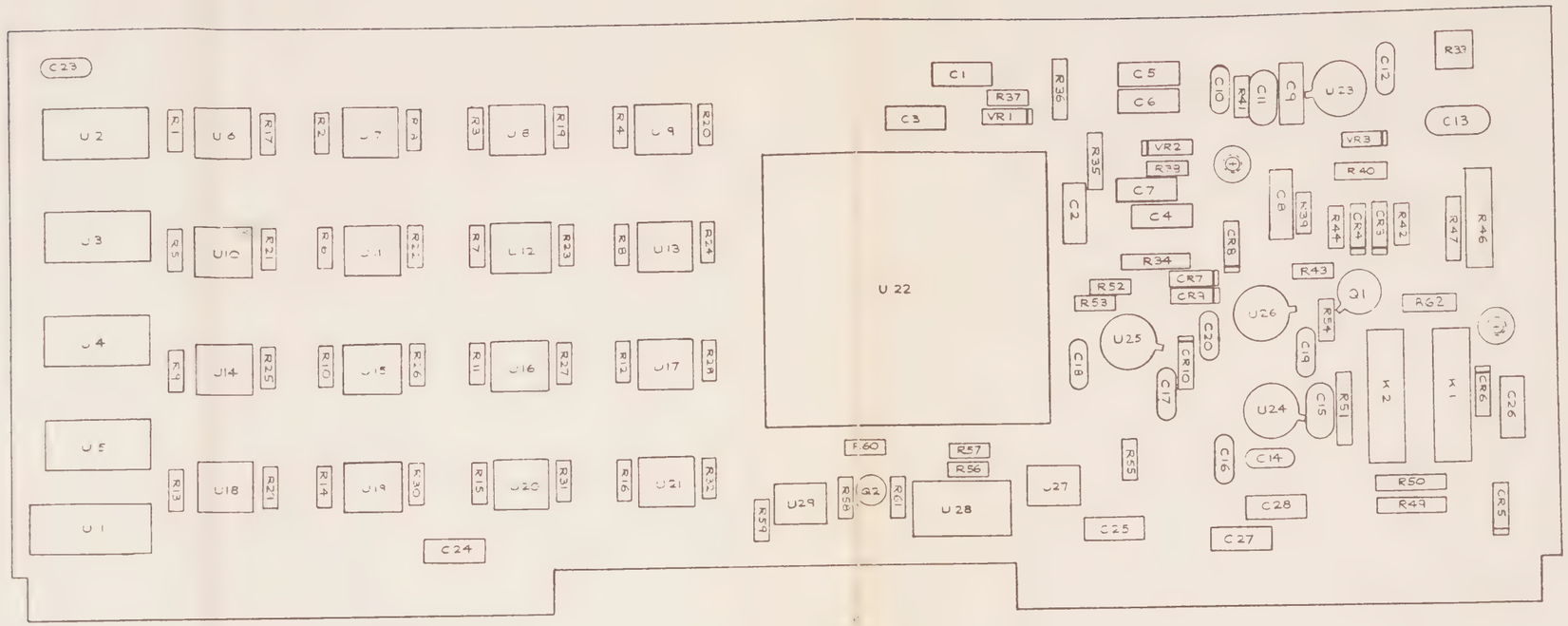
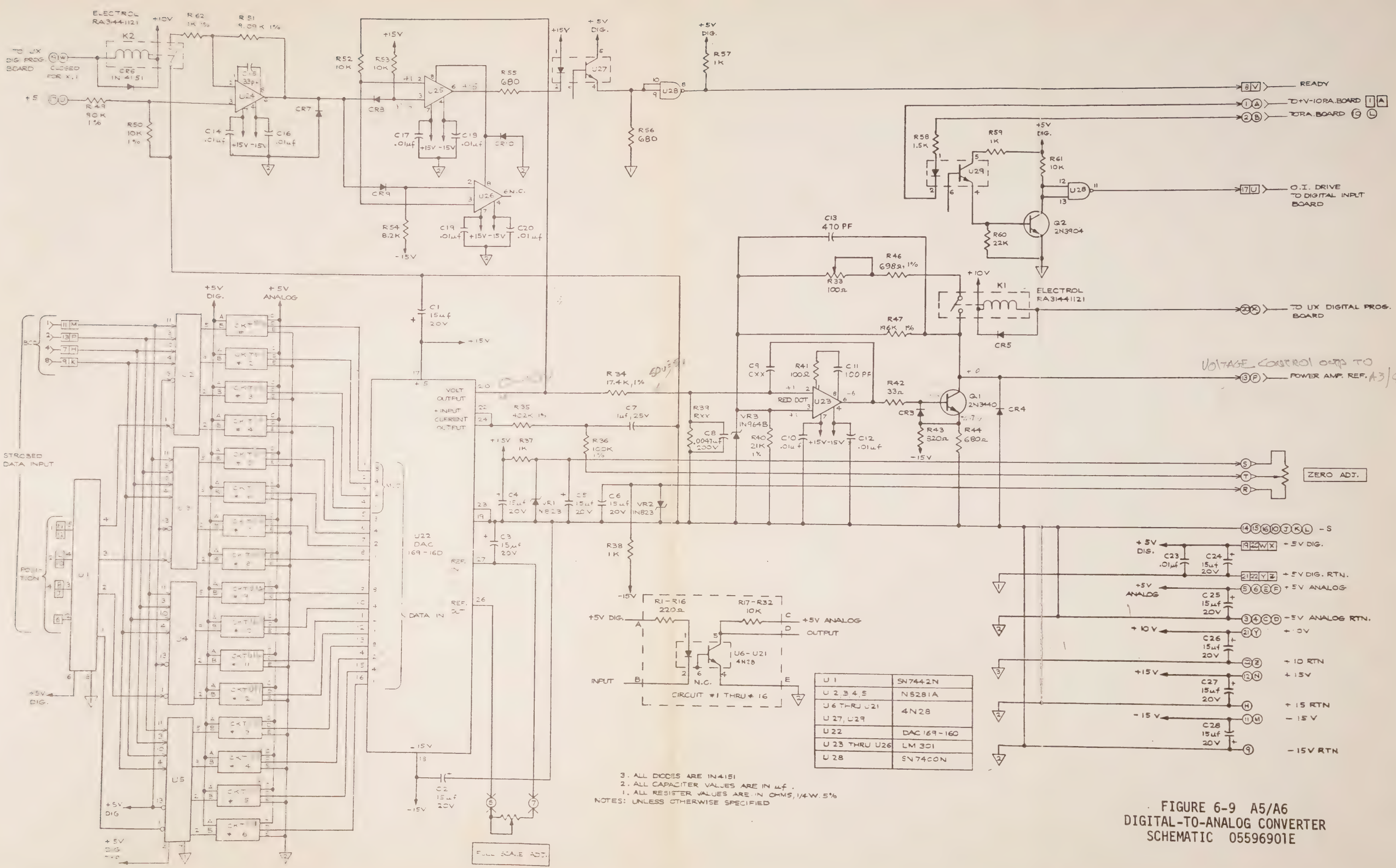


FIGURE 6-8 A5/A6
DIGITAL-TO-ANALOG CONVERTER
PC ASSEMBLY 05596901E



U 1	SN7442N
U 2,3,4,5	N5281A
U6 THRU U21 U27, U29	4N28
U 22	DAC 169-160
U 23 THRU U26	LM 301
U 28	SN74CON

3. ALL DIODES ARE IN4151
2. ALL CAPACITER VALUES ARE IN uf.
1. ALL RESISTER VALUES ARE IN OHMS, 1/4W 5%
NOTES: UNLESS OTHERWISE SPECIFIED

FIGURE 6-9 A5/A6
DIGITAL-TO-ANALOG CONVERTER
SCHEMATIC 05596901E

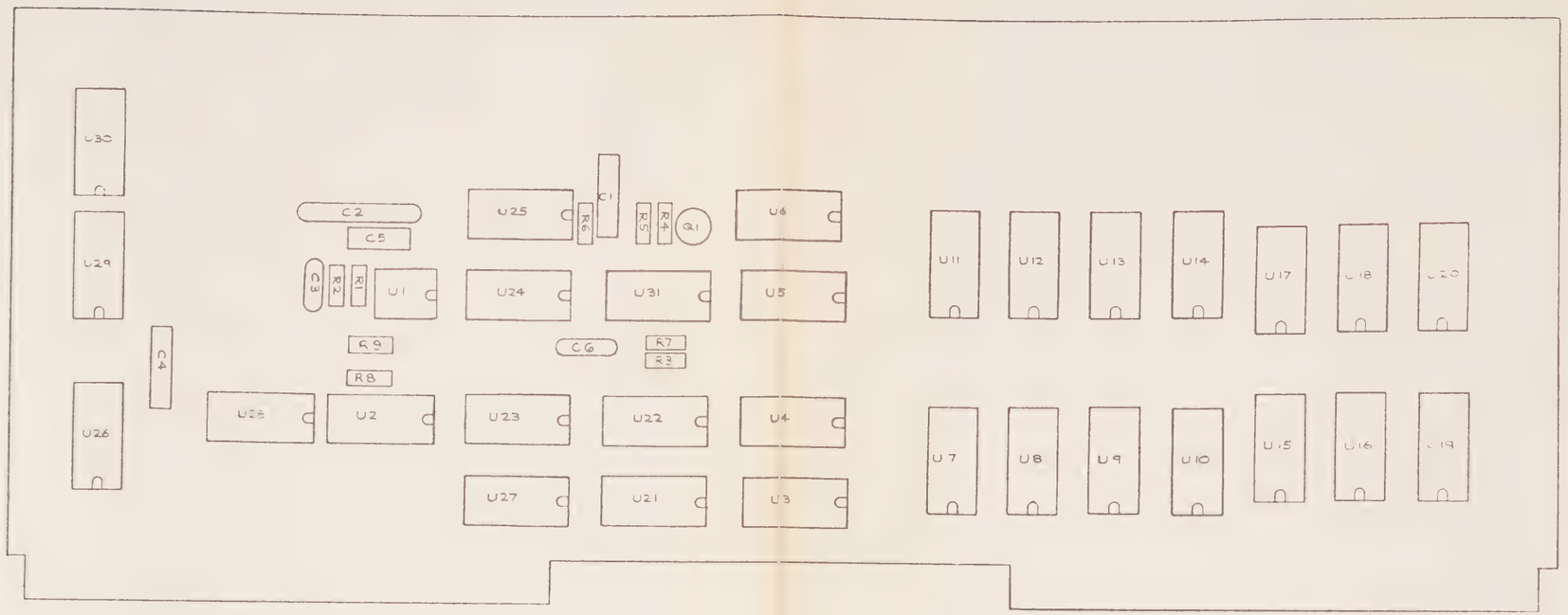


FIGURE 6-10 A7
DIGITAL PROGRAMMING
PC ASSEMBLY 05596801C

I.C. POWER PIN HOOK-UP			
REF #	TYPE	GND	+5V
U1	NE555A	1	8
U2	8281	7	14
U3 THRU U6	74151	8	16
U7 THRU U20	8281	7	14
U21	7474	7	14
U22	3000	7	14
U23	MC3021P	7	14
U24 & U25	7404	7	14
U26 THRU U29	7417	7	14
U30 & U31	7416	7	14

U26 → U30 GND PINS CONNECT SEPARATELY TO +10V RET. ONLY.

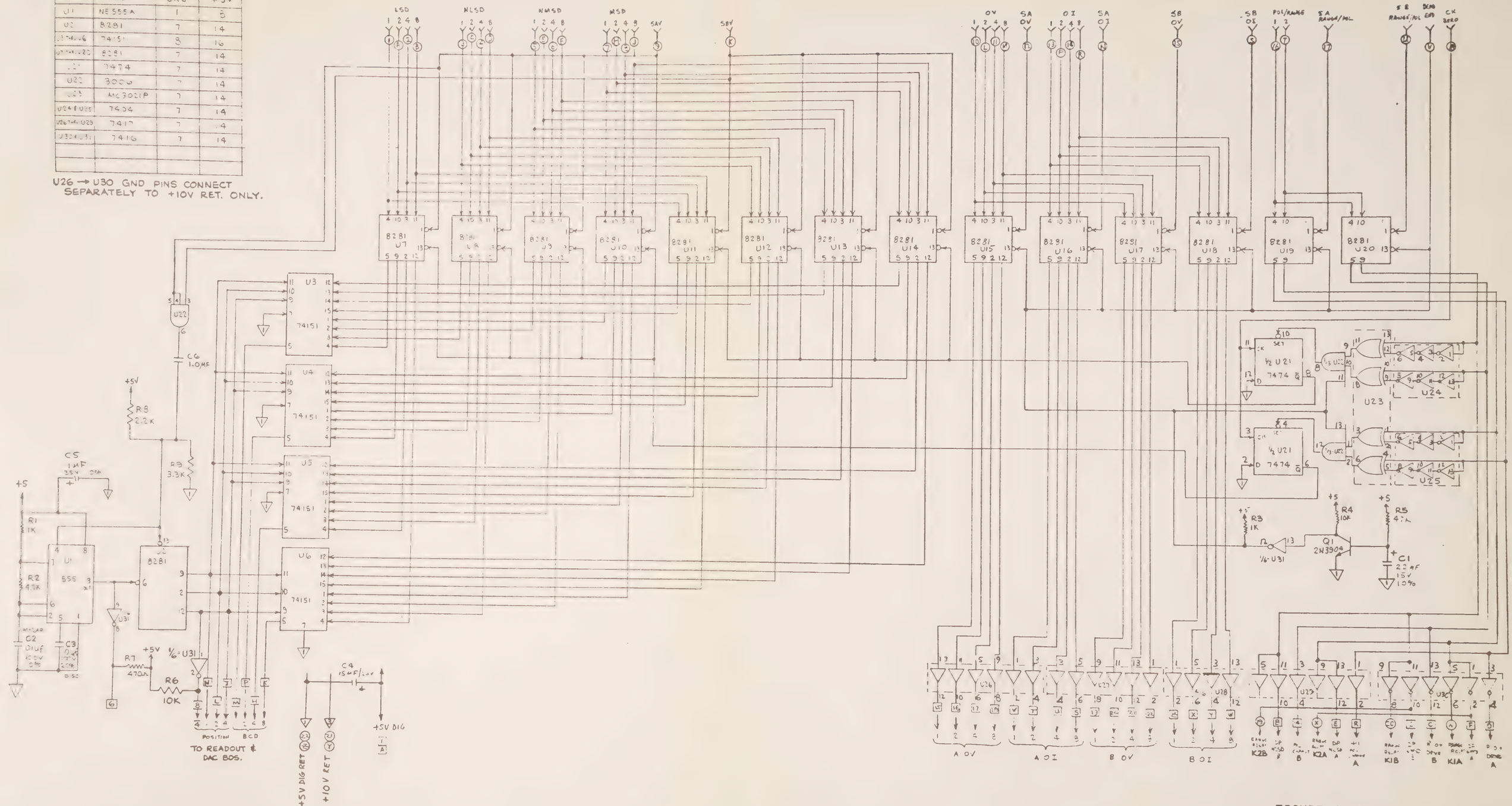
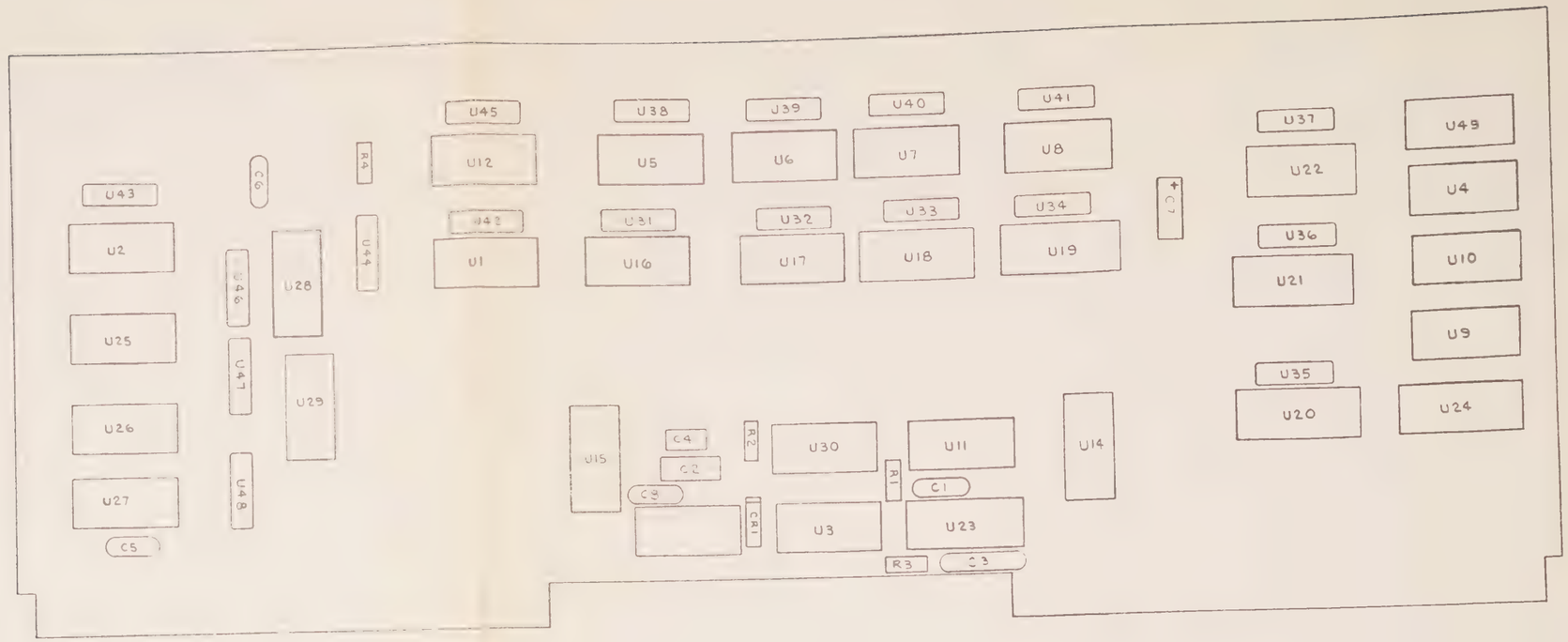


FIGURE 6-11 A7
DIGITAL PROGRAMMING
SCHEMATIC 05596801C



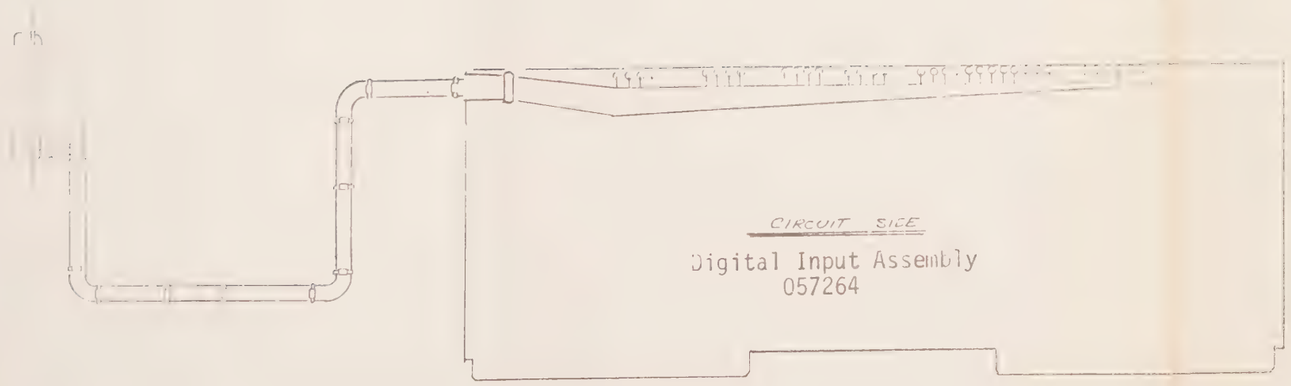


FIGURE 6-12 A8
DIGITAL INPUT
PC ASSEMBLY 05596701B

I.C. POWER PIN HOOK-UP			
REF ⇐	TYPE	GND	+5V
U1	7417	7	14
U2 THRU U4	7400	7	14
U5 THRU U12 & U49	7408	7	14
U13	7404	7	14
U14 & U15	74180	7	14
U16 THRU U22	74157	8	16
U23	74123	8	16
U24	7442	8	16
U25 THRU U27	MC3021P	7	14
U28 & U29	7430	7	14
U30	7432	7	14

U31 THRU U48 ARE 5K RESISTOR PACK 1/1CW

FIGURE 6-13 A8
DIGITAL INPUT
SCHEMATIC 05596701B

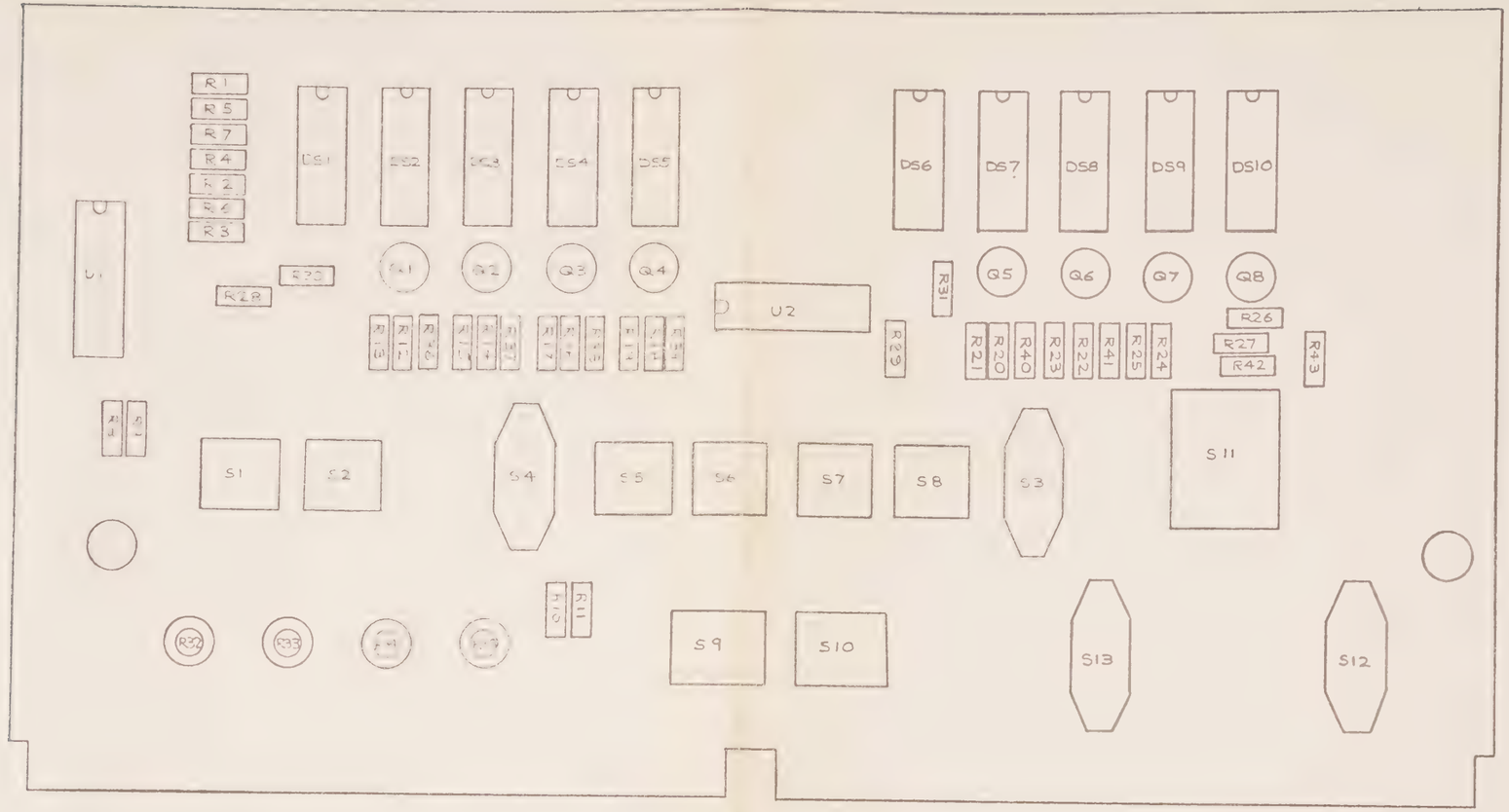
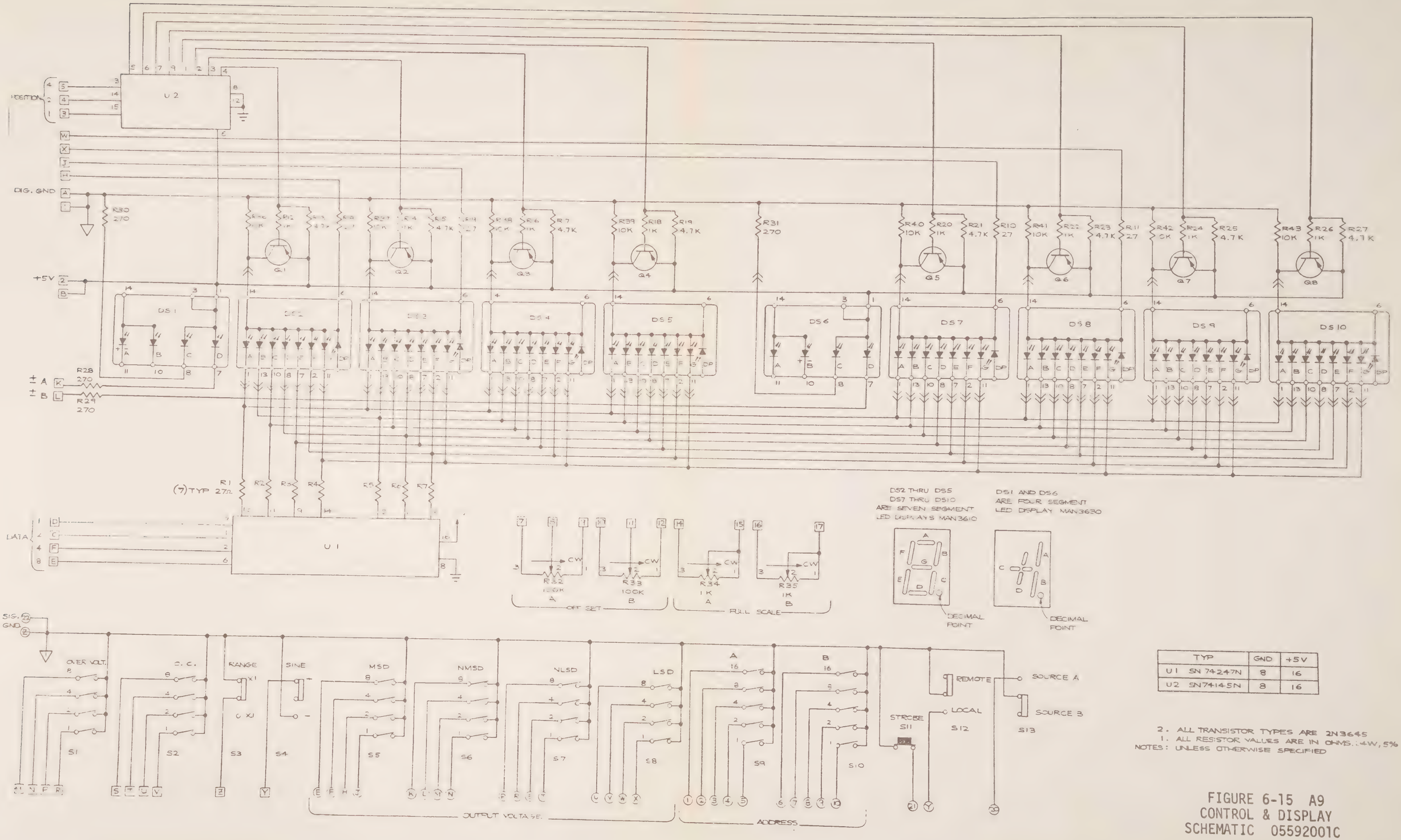


FIGURE 6-14 A9
CONTROL & DISPLAY
PC ASSEMBLY 05593001C$_1$



TYP	GND	+5V
U1 SN 74247N	8	16
U2 SN7414-5N	8	16

NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES ARE IN OHMS, ¼W, 5%
2. ALL TRANSISTOR TYPES ARE 2N3645

FIGURE 6-15 A9
CONTROL & DISPLAY
SCHEMATIC 05592001C

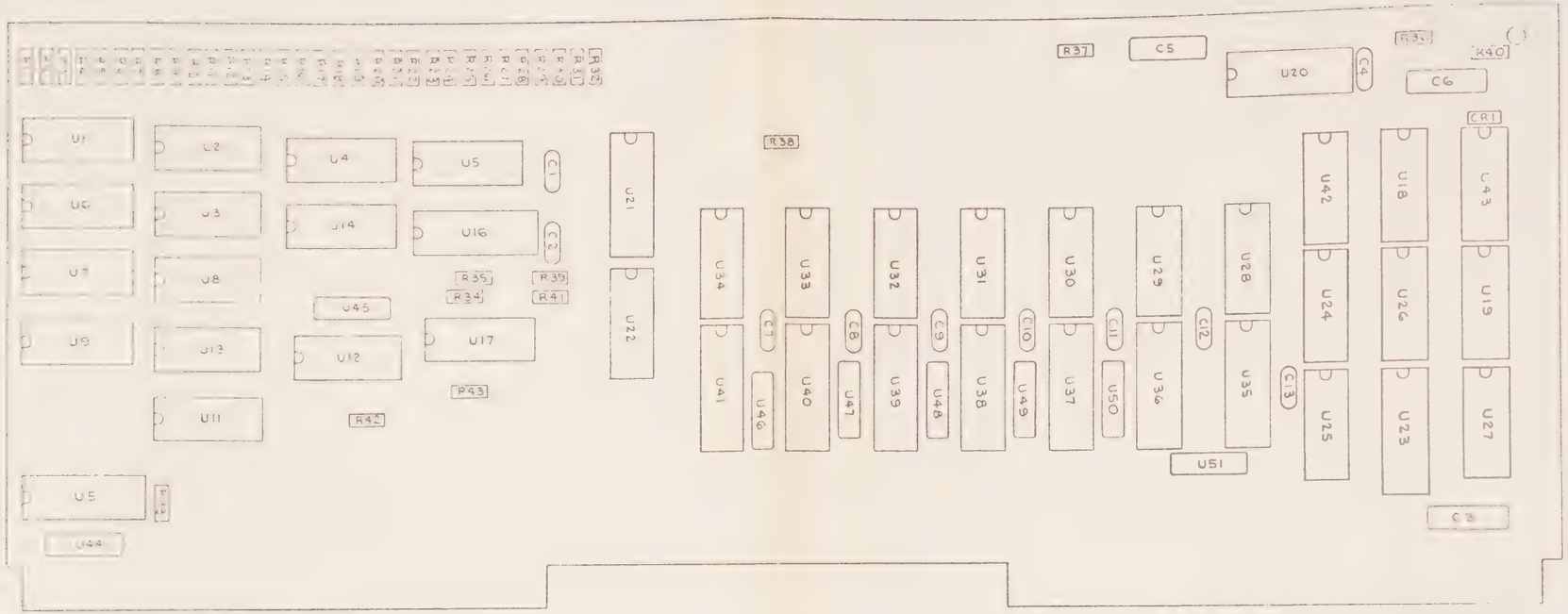


FIGURE 6-16 OPTION 01
IEEE-488 INPUT
PC ASSEMBLY 05726301B

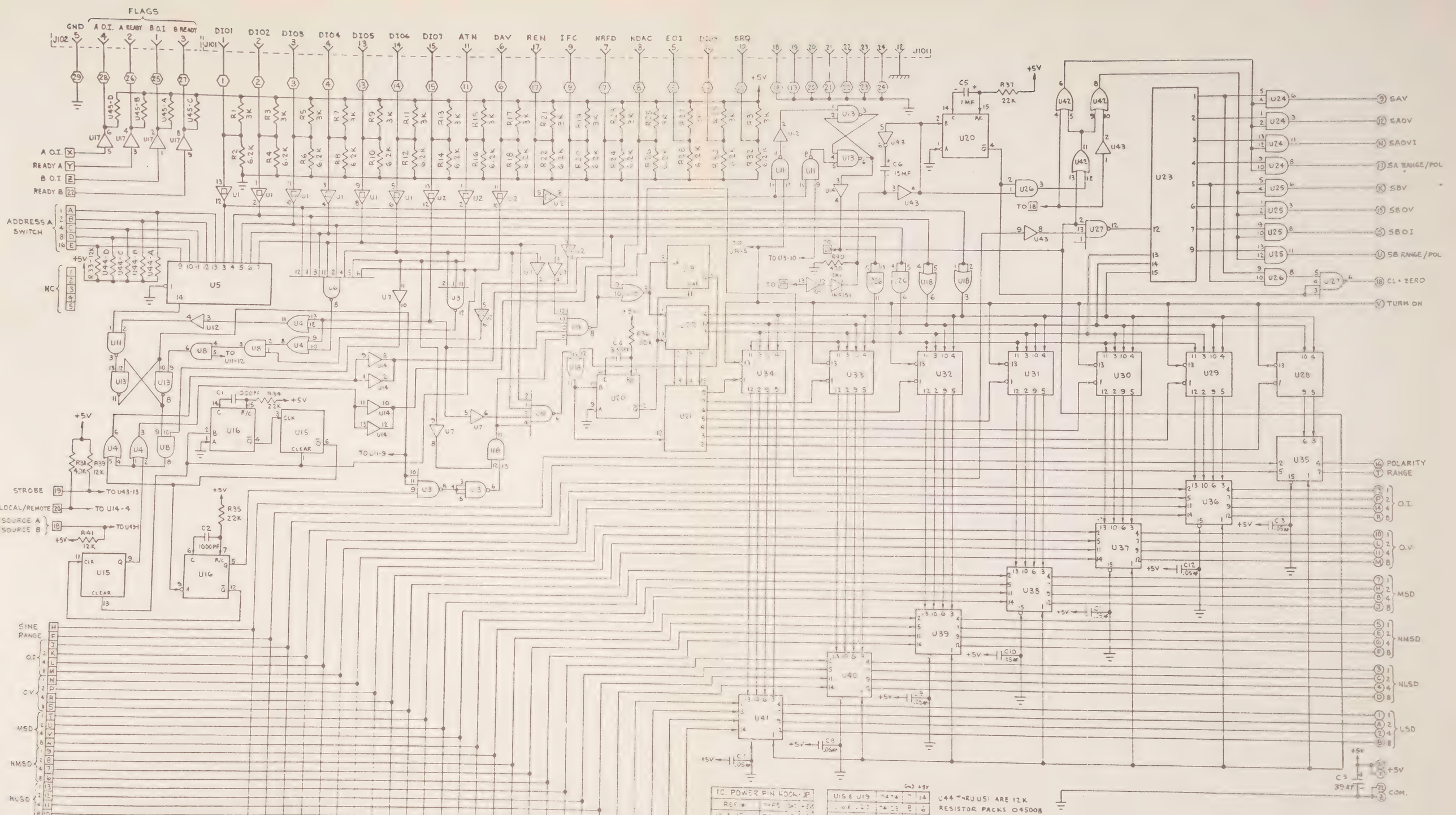
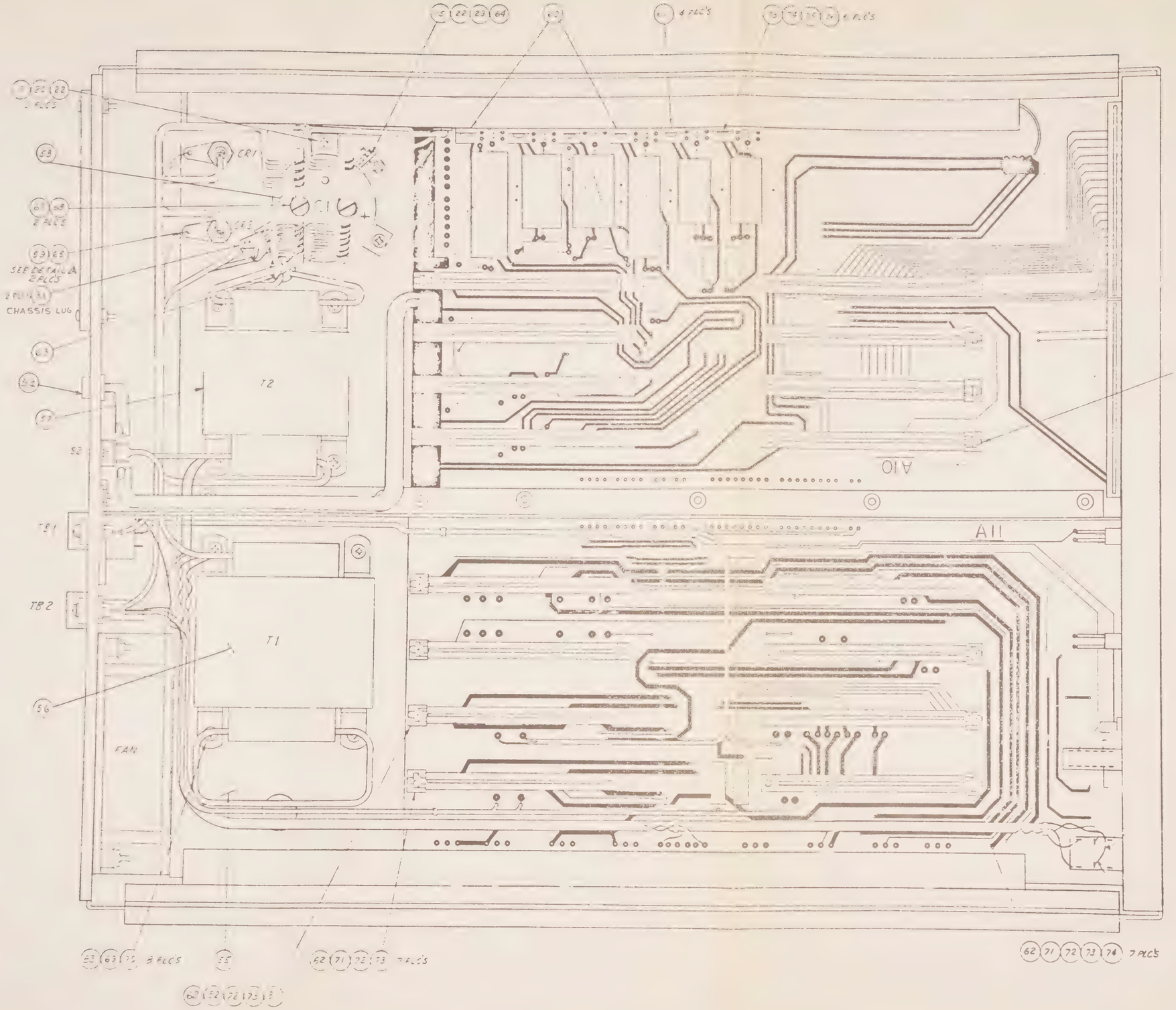
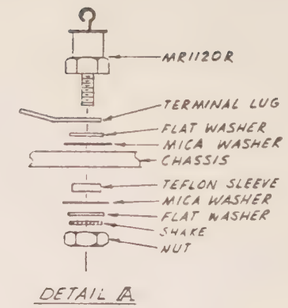
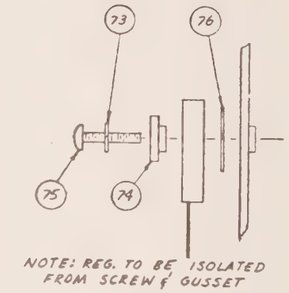


FIGURE 6-17 OPTION 01
IEEE-488 INPUT
SCHEMATIC 05726301B





DETAIL A



DETAIL B

FIGURE 6-18
DPSD-50 TEST ASSEMBLY 0570978$_1$
(Sheet 1 of 3)

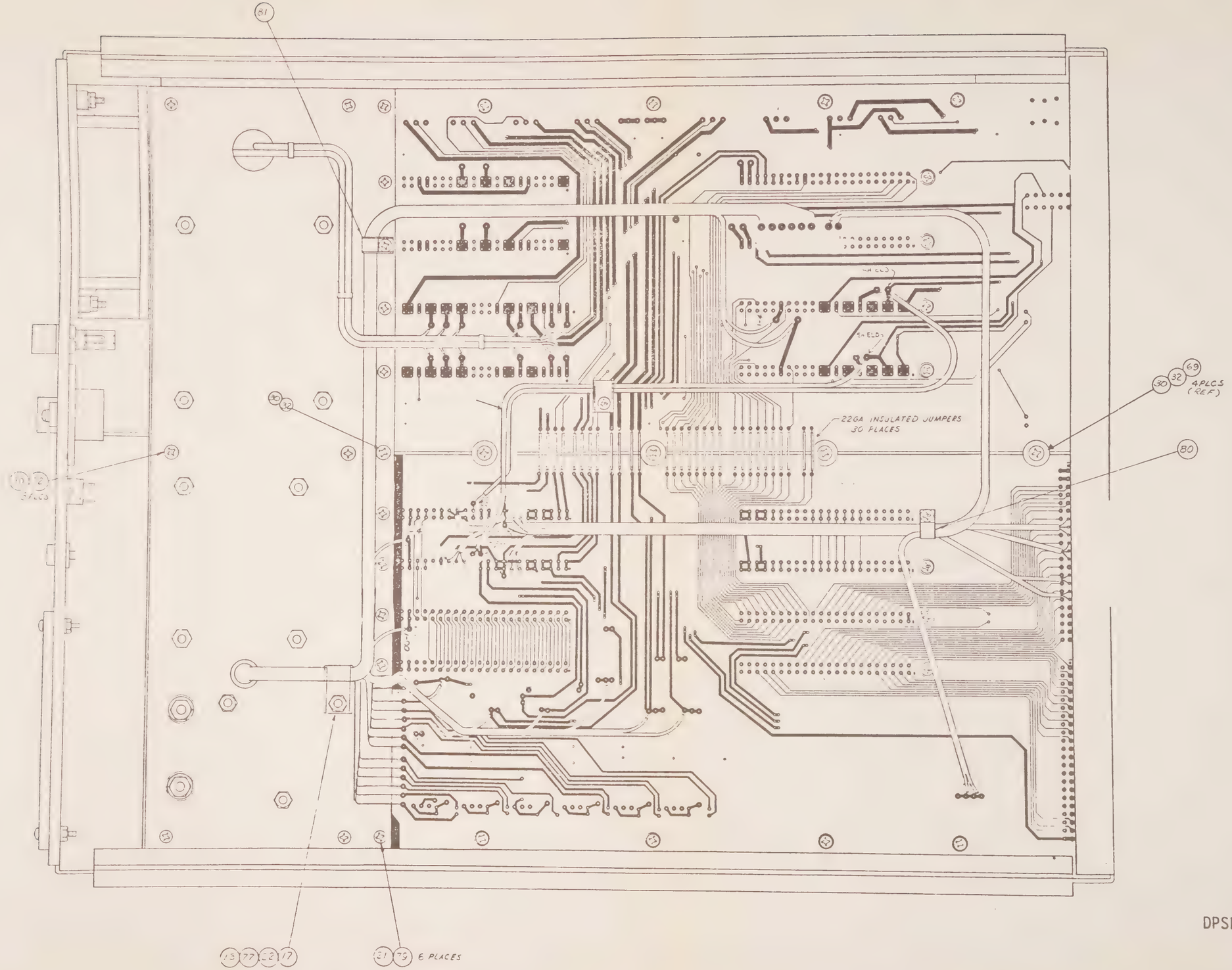


FIGURE 6-18
DPSD-50 TEST ASSEMBLY 057097B$_1$
(Sheet 2 of 3)

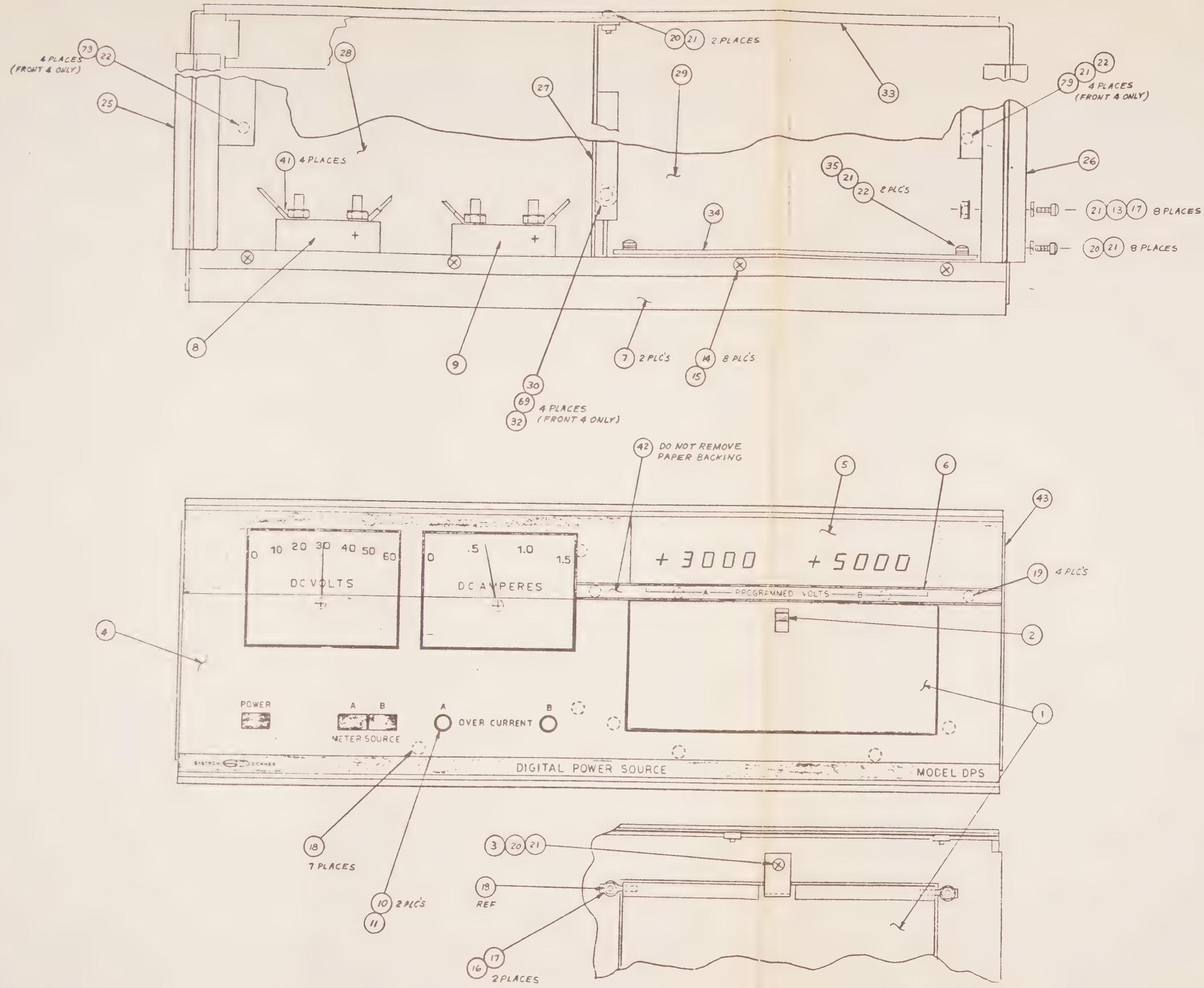


FIGURE 6-18
DPSD-50 TEST ASSEMBLY 057097B1
(Sheet 3 of 3)

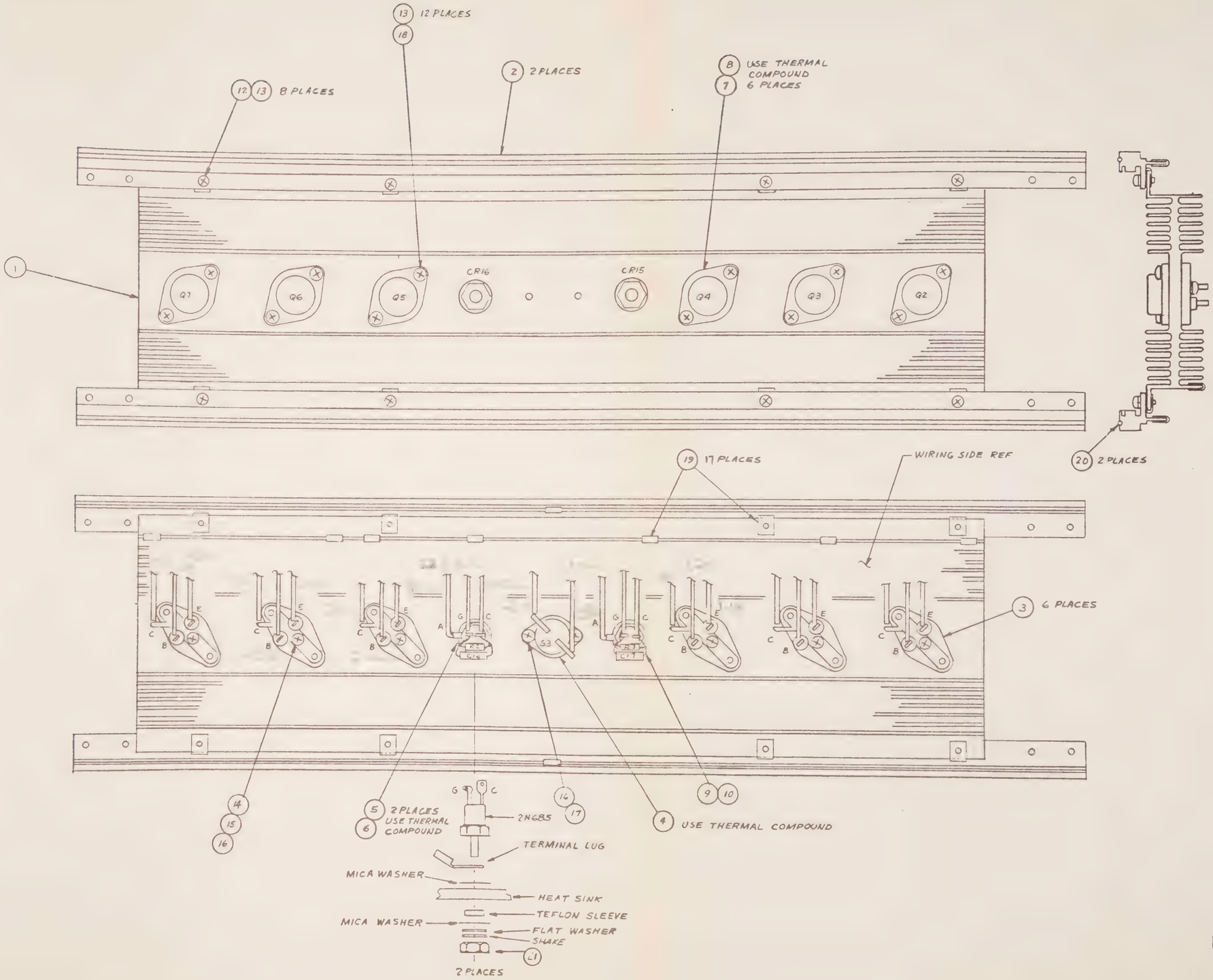


FIGURE 6-19
HEAT SINK ASSEMBLY 057090B

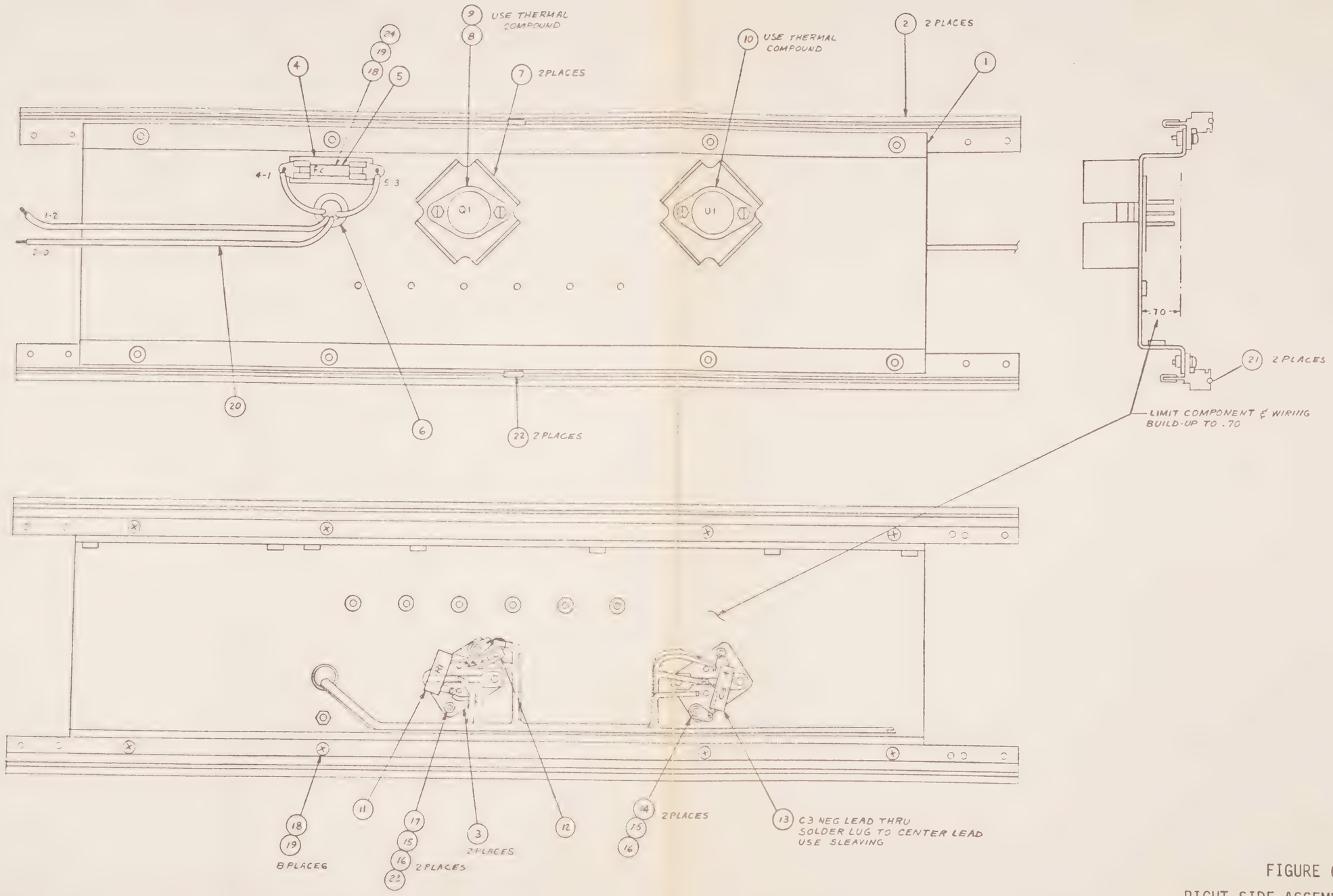


FIGURE 6-20
RIGHT SIDE ASSEMBLY 057080A$_1$

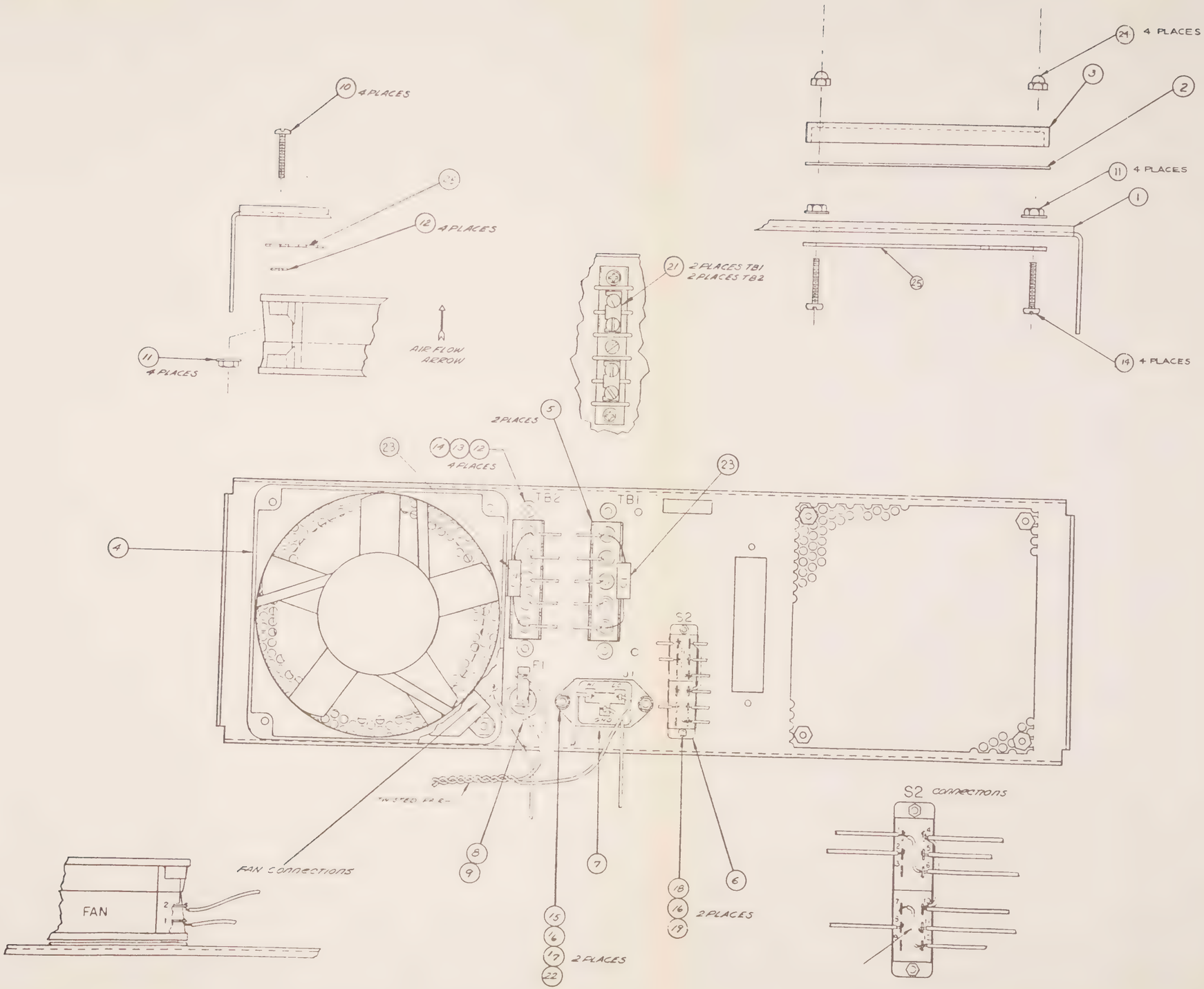


FIGURE 6-21
REAR PANEL ASSEMBLY 057092B$_1$

CHAPTER 7
PARTS LISTS

7.1 INTRODUCTION

This chapter contains the spare parts lists for each assembly in the Model DPSD-50 Digital Power Source. Chapter 6 shows the assemblies where the listed parts are installed. Ordering information is included and should be used when purchasing parts from the factory. The parts are contained in the Replaceable Parts List. Explanation of the column listings and a Table 7-1 Manufacturer's Code-To-Name Index are also included.

7.2 PART ORDERING INFORMATION

To order a part from the Replaceable Parts List, state the Systron-Donner part number, indicate the quantity required and address the order to the nearest Systron-Donner Sales or Service Center.

To order a part not listed in the Replaceable Parts List, state the instrument model number, instrument serial number, and description and function of the part, and the number of parts required. Address the order to the nearest Systron-Donner Sales or Service Center.

7.3 PARTS LISTS

Table 7-1 gives the code-to-name information for the manufacturers listed in the replaceable parts lists in A numbered sequence. Table 7-2 provides a listing of the assembly parts lists and page numbers.

Each column in the parts lists provides specific information relating to the listed parts as follows:

(1) DESIGNATOR: Reference numbers applicable to assemblies are listed in alphanumeric order.

(2) COMPONENT NOMENCLATURE AND DESCRIPTION: Component names and specifications are provided in these columns and include value, tolerance, wattage rating, working voltage, construction, etc.

(3) MANUFACTURER'S CODE: H4-2 Federal Supply Code numbers are listed to identify component manufacturers. A Manufacturers Index is provided in this chapter for cross-reference.

(4) MANUFACTURER'S PART NUMBER: True manufacturer part numbers are listed in this column.

(5) S-D STOCK NUMBER: The Systron-Donner stock number is listed in this column.

(6) T/Q (Total Quantity): This quantity, appearing after an item entry, indicates the number of times the component is used in that assembly.

TABLE 7-1 PARTS LISTS LOCATION

TITLE	ASSEMBLY NUMBER	PAGE NUMBER
Final Assembly	057101	7-7
Test Assembly	057097	7-8
Heat Sink Assembly Left Side	057090	7-11
Right Side Assembly	057080	7-12
Rear Panel Assembly	057092	7-13
Analog Mother Board PC Assembly	05597101	7-14
Digital Mother Board PC Assembly	05597001	7-15
A1 & A2, Sign & Overvoltage PC Assembly	05590401	7-17
A3 & A4, Power Amp & Overcurrent PC Assembly	05593801	7-22
A5 & A6, Digital To Analog PC Assembly	05596901	7-28
A7, Digital Programming Assembly	05596801	7-34
A8, Digital Input PC Assembly	05596701	7-36
A9, Control & Display PC Assembly	05593001	7-39
Option 01 IEEE-488 Assembly	05733501	7-42
Option 01 IEEE-488 Input PC Assembly	05726301	7-43

TABLE 7-2 MANUFACTURER'S CODE-TO-NAME INDEX

CODE	NAME	ADDRESS
00392	General Scientific Equipment Co.	P.O. Box 5277, Hamden, CT. 00392
00779	Amp Inc.	P.O. Box 3608, Harrisburg, PA 17105
00853	Sangamo Electric Co. So. Carolina Div.	P.O. Box 128, Pickens, SC 29671
01121	Allen-Bradley Co.	1201 So. 2nd St., Milwaukee, WI 53204
01295	Texas Instruments Inc. Semiconductor & Components Division	13500 No. Central Expressway Dallas, TX 75231
02660	Bunker Ramo Corp. Amphenol Connector Div.	2801 So. 25th Ave., Broadview, IL. 60153
02735	RCA Corp. Solid State Division	Route 202, Somerville, N.J. 08876
03508	General Electric Co. Semiconductor Products Dept.	Electronics Park, Syracuse, N.Y. 13201
03877	Transitron Electronic Corp.	168-186 Albion St., Wakefield, MA 01880
04713	Motorola Semiconductor Products Inc.	5005 E. McDowell Rd., Phoenix, AZ 85008
05574	Viking Industries Inc.	21001 Nordhoff, Chatsworth, CA 91311
06383	Panduit Corp.	17301 Ridgeland, Tinley Park, IL 60477
06540	Amatom Electronic Hardware	81 Rockdale Ave., New Rochelle, N.Y. 10806
06776	Robinson Nugent Inc.	P.O. Box 470, New Albany, IN 47150
07263	Fairchild Camera & Instrument Corp. Semiconductor Division	313 Frontage Rd., Mountain View, CA 94040
08289	Blinn Delbert Co. Inc., The	P.O. Box 2007, 1678 Mission Blvd. Pomona, CA 91766
13103	Thermalloy Co.	2021 W. Valley View Ln., Dallas, TX 75234
13150	Vernitron Electrical Component Beau Products Division	P.O. Box 10, Laconia, N.H. 03246
14604	Elmwood Sensors Inc.	1655 Elmwood Ave, Cranston, R.I. 02907
14752	Electro Cube Inc.	1710 So. Del Mar Ave., San Gabriel, CA 91776

TABLE 7-2 MANUFACTURER'S CODE-TO-NAME INDEX (Cont'd)

CODE	NAME	ADDRESS
15915	Tepro of Florida Inc.	2608 Enterprise Rd., Dunedin, FL 33528
18324	Signetics Corp.	811 E. Arques, Sunnyvale, CA 94086
18612	Vishay Resistor Products Div. Vishay Intertechnology	68 Lincoln Hwy., Malvern, PA 19355
19701	Mepco/Electra Inc. Electra Division	P.O. Box 760, Mineral Wells, TX 76067
22229	Solitron Devices Inc.	8808 Balboa Ave., San Diego, CA 92123
27014	National Semiconductor Corp.	2950 San Ysidro Way, Santa Clara CA 95051
27264	Molex Products Co.	5224 Katrine Ave., Downers Grove, IL 60515
27556	IMB Electronic Prod. Inc.	15401-E Carmenita Rd., Santa Fe Santa Fe Springs, CA 90670
28520	Heyman Mfg. Co.	147 N. Michigan Ave., Kenilworth N.J. 07033
31918	International Electro Exchange Inc.	8081 Wallace Rd., Eden Prairie, N.M. 55343
32159	West-Cap Arizona	2201 E. Elvira Rd., Tucson, AZ 85706
34553	Amperex Electronic Corp. Component Division	35 Hoffman Ave., Hauppauge, N.Y. 11787
35434	Lectrohm Inc.	5560 Northwest Hwy., Chicago, IL 60630
50522	Monsanto Co. Electronic Special Products	10131 Bubb Rd., Cupertino, CA 95014
50721	Datel Systems Inc.	1020 Turnpike St., Conton, MA 02021
52542	Systron-Donner Corp. Instrument Division	10 Systron Dr., Concord, CA 94518
54453	Sullins Electronic Corp.	P.O. Box 757, 275 Pico Ave., San Marcos, CA 92069
56289	Sprague Electronic Co.	North Adams, MA 01247
71279	Cambridge Thermonic Corp.	445 Concord Ave., Cambridge, MA 01238
71590	Globe-Union Inc. Centralab Electronics Div.	5757 No. Green Bay Ave., Milwaukee, WI 53201

TABLE 7-2 MANUFACTURER'S CODE-TO-NAME INDEX (Cont'd)

CODE	NAME	ADDRESS
72136	Electro Motive Mfg. Co. Inc.	South Park & John Sts. Willimantic, CO 06226
73138	Beckman Instruments Inc. Helipot Div.	2500 Harbor Blvd., Fullerton, CA 92634
73734	Federal Screw Products Inc.	3917 N. Kenzier Ave., Chicago, IL 60618
73803	Texas Instruments Inc. Metallurigical Meterials Div	Attleboro, MA 02703
74970	E.F. Johnson Co.	299-10th Ave. S.W., Waseca, MN 56093
75915	Littlefuse Inc.	800 E. Northwest Hwy., Des Plaines, IL 60016
78189	Illinois Tool Works Inc. Shakeproof Div	St. Charles Rd., Elgin, IL 60120
78553	Tinnerman Products Inc.	8700 Brookpark Rd., Cleveland, OH 44129
79727	C-W Industries	P.O. Box 96, 550 Davisville, Warminister, PA 18974
79963	Zierick Mfg. Co.	Radio Circle, Mt. Kisco, N.Y. 10549
80294	Bourns Inc. Instrument Div	6135 Magnolia Ave., Riverside, CA 92506
81104	Sackner Products Inc.	901 Ottawa, N.W. Grand Rapids, MI 49502
81312	Litton Industries Inc. Winchester Electronics Div.	Main St & Hillside Ave., Oakville, CT 06779
81483	International Rectifier Corp.	9220 Sunset Blvd., Los Angeles, CA 90069
82389	Switchcraft Inc.	5555 N. Elston Ave., Chicago, IL 60630
83330	Herman H. Smith Inc.	812 Snediker Ave., Brooklyn, N.Y. 11207
83781	National Electronics Inc.	P.O. Box 269, Geneva, IL 60134
84411	TRW Electronic Components Capacitor Division	112 W. First St., Ogallala, NE 69153
86928	Seastrom Mfg. Co. Inc.	701 Sonora Ave., Glendale, CA 91201
88245	Litton Systems Inc.	13536 Saticoy St., Van Nuys, CA 91409

TABLE 7-2 MANUFACTURER'S CODE-TO-NAME INDEX (Cont'd)

CODE	NAME	ADDRESS
90201	Mallory Capacitor Co.	P.O. Box 372, 3029 E. Washington St. Indianapolis, IN 46206
91418	Radio Materials Co.	4242 W. Bryn Mawr, Chicago, IL . 60646
91637	Dale Electronics Inc.	P.O. Box 609, Columbus, NE 68601
92702	IMC Magnetics Corp. Eastern Division	570 Main St., Westbury Long Island, N.Y. 11591
94222	Southco Inc.	Lester, PA 19113
95987	Weckesser Co. Inc.	4444 W. Irving Park Rd., Chicago, IL 60641
98978	International Electronic Research Corp	135 W. Magnolia Ave., Burbank, CA 91502
99392	S T M Corp.	2904 Chapman St., Oakland, CA 94601
99515	ITT Jennings Monrovia Plant Div of ITT Jennings	1960 Walker Ave., Monrovia, CA 91016

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION FINAL ASSEMBLY 057101

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
4		ASSEMBLY, TEST	52542	057097	057097	1
6		COVER: Top	52542	057144	057144	1
7		COVER: Bottom	52542	057145	057145	1
8		TRIM: Rack Mtg.	52542	32001286	32001286	2
9		HANDLE	06540	11519-A-0832-2	100972	2
10		SUPPORT: Rear	52542	03995103	03995103	2
12		COVER: Side	52542	065023	065023	2
15		SCREW: PHMS 8-32 x 5/8	96906	MS51957-46	10064210	4
16		WASHER: Int Tooth #8	96906	MS35333-72	100687	4
17		SCREW: FHMS 8-32 x 3/8	96906	MS24693-C48	10074306	4
23		CORD: Line	70903	BR1736	102407	1
28		CONNECTOR: 50-pin	81312	SME50PJTCH8	101215	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION TEST ASSEMBLY 057097

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		ASSEMBLY: DPSD Test	52542	057097	057097	
1		DOOR	52542	055895	055895	1
2		DOOR: Latch	94222	A3-10-310-12	103858	1
3		DOOR: Stop	52542	055901	055901	1
4		PANEL: Decorative	52542	055883	055883	1
5		WINDOW	52542	055865	055865	1
6		TRIM: Strip	52542	055893	055893	1
7		TRIM: Front	52542	32001203	32001203	2
8	M1	METER: DC Volts	52542	055830	055830	1
9	M2	METER: DC Amperes	52542	057141	057141	1
10	DS1	LAMP: Overcurrent Source A	52542	770023	770023	2
	DS2	Same as DS1 Source B				
11	XDS1	LAMP: Retainer P/O DS1				
	XDS2	Same as XDS1 P/O DS2				
13		SCREW: PHMS 6-32 x 7/16	96906	MS51957-29	10063207	9
14		SCREW: FHMS 6-32 x 1/4	96906	MS24693-C24	10073104	8
15		NUT: #6 Tinnerman	78553	C1887-632-4	102944	9
16		SPADE BOLT: Non-Threaded	73734	5460	103863	2
17		NUT: 6-32 Kep	78189	511-061800-00	100862	13
18		SCREW: FHMS 6-32 x 5/16	96906	MS24693-C25	10073105	7
19		SCREW: FHMS 2-56 x 1/4	96906	NAS662C2R4	10070004	4
20		SCREW: PHMS 6-32 x 5/16	96906	MS51957-27	10063205	13
21		WASHER: #6 Split	96906	MS35338-136	100712	31
22		WASHER: #6 Flat	96906	MS15795-805	100704	14
23		SCREW: PHMS 6-32 x 1/2	96906	MS51957-30	10063208	1
25		ASSEMBLY: Heat Sink	52542	057090	057090	1
26		ASSEMBLY: Right Side	52542	057080	057080	1
27		WALL: Center	52542	055892	055892	1
28	A11	PC ASSEMBLY: Analog Mother Board	52542	05597101	05597101	1
29	A10	PC ASSEMBLY: Digital Mother Board	52542	05597001	05597001	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION TEST ASSEMBLY 057097 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
30		SCREW: PHMS 8-32 x 3/8	96906	MS51957-43	10064206	7
31		LUG: Solder #6	83330	1413-6	100486	2
32		WASHER: #8 Split	96906	MS35338-137	100713	7
33		ASSEMBLY: Rear Panel	52542	057092	057092	1
34	A9	PC ASSEMBLY: Control and Display	52542	05593001	05593001	1
35		SCREW: PHM 6-32 x 3/4	96906	MS51957-32	10063212	2
41		SOLDER LUG: #10 Int. Tooth	79963	622-.196	100491	4
42		STRIP: Nomen	52542	055954	055954	1
43		PANEL: Sub	52542	055896	055896	1
50	A1	PC ASSEMBLY: Sign and Over-voltage Source B	52542	05590401	05590401	2
	A2	Same as A1 Source A				
51	A3	PC ASSEMBLY: Power Amp and Overcurrent Source B	52542	05593801	05593801	2
	A4	Same as A3 Source A				
52	A5	PC ASSEMBLY: Digital to Analog Source B	52542	05596901	05596901	2
	A6	Same as A5 Source A				
53	A7	PC ASSEMBLY: Digital Programming	52542	05596801	05596801	1
54	A8	ASSEMBLY: Digital Input	52542	057264	057264	1
55		CHASSIS	52542	055898	055898	1
56	T1	TRANSFORMER	52542	055935	055935	1
57	T2	TRANSFORMER	52542	055934	055934	1
58	C1	CAPACITOR: Fixed Elect 30,000 µF, 15 V	99392	91S15JA34	103188	1
59	CR1	DIODE	04713	MR1120R	100424	2
	CR2	Same as CR1				
60	U2	INTEGRATED CIRCUIT: Voltage Regulator +5V	04713	MC7805CP	045256	2
	U7	Same as U2				
61	U3 thru U6	INTEGRATED CIRCUIT: Voltage Regulator +15V	04713	MC7815CP	103039	4

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION: TEST ASSEMBLY 057097 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
62		CARD: Guide	52542	33000308	33000308	16
63		GROMMET	28520	SB-500-6	100680	1
64		CLAMP: Capacitor C1	90201	VR8	106879	1
65		7/16 STUD: Diode Mtg Kit P/O CR1 and CR2	Moto.	MH745		2
66		SCREW: PHMS 4-40 x 5/8	96906	MS51957-18	10062610	2
67		LUG: Solder #10	79963	20-.196	101015	4
68		WASHER: #10 Flat	96906	MS15795-808	100648	2
69		WASHER: #8 Flat	96906	MS15795-807	100705	12
70		NUT: 8-32 Kep	78189	511-81800-00	100940	8
71		SCREW: PHMS 4-40 x 3/4	96906	MS51957-19	10062612	14
72		NUT: 4-40	96906	MS35649-244	106976	16
73		WASHER: #4 Split	96906	MS35338-135	100711	22
74		WASHER: #4 Shoulder	83330	2661	102868	14
75		SCREW: 4-40 x 5/16	96906	MS51957-14	10062605	6
76		WASHER: Mica	08289	SK-73-48-13	103352	6
77		CLAMP: 3/8 Cable	95987	3/8-4NA	100718	1
79		SCREW: PHMS 6-32 x 3/8	96906	MS51957-15	10063206	14
80		CLAMP: 1/2 Cable	95987	1/2-4	100765	1
81		CLAMP: 1/4 Cable	95987	1/4-4NA	100716	2
82		SCREW: PHMS 4-40 x 1	96906	MS51957-21	10062616	2
83		SCREW: PHMS 8-32 x 7/16	96906	MS51957-44	10064207	8

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION HEAT SINK ASSEMBLY LEFT SIDE 057090

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1		HEAT SINK	52542	055900	055900	1
2		TRIM: Side	52542	055866	055866	2
3	XQ2 thru XQ7	SOCKET: TO-3	06776	MD-3452	103030	6
4	S3	SWITCH: Thermal	14604	2450-88-16	880007	1
5	CR15	DIODE: SCR	04713	2N685	720000	2
	CR16	Same as CR15				
6		11/16 STUD: Diode Mtg Kit P/O CR15 and CR16	04713	MH746		2
7	Q2 thru Q7	TRANSISTOR	04713	2N3447	705071	6
8		WASHER: Insulator Mica TO-3 P/O Q2-Q7	08289	DM-103	102940	6
9	C16	CAPACITOR: Fixed Mylar 0.1 µF 10%, 100 V	99515	DE1-104E	100141	2
	C17	Same as C16				
10	R2	RESISTOR: Fixed Comp 1 k 5%, 1/4 W	01121	CB1025	101569	2
	R3	Same as R2				
12		SCREW: PHMS 6-32 x 3/8	96906	MS51957-28	10063206	8
13		WASHER: #6 Split	96906	MS35338-136	100712	20
14		SCREW: PHMS 4-40 x 1/2	96906	MS51957-17	10062608	6
15		WASHER: #4 Flat	96906	MS15795-803	100703	6
16		WASHER: #4 Split	96906	MS35338-135	100711	8
17		SCREW: PHMS 4-40 x 3/8	96906	MS51957-15	10062606	2
18		SCREW: PHMS 6-32 x 5/8	96906	MS51957-31	10063210	6
19		NUT: 6-32 Tinnerman	78553	C1887-632-4	102944	17
20		CORD: Black Trim Vinyle	81104	2481	100938	A/R
21		NUT: Transistor	73734	9006	103862	2

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION RIGHT SIDE ASSEMBLY 057080

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
		ASSEMBLY: Right Side	52542	057080	057080	1
		GUSSET: Right	52542	055899	055899	1
		TRIM: Side	52542	055866	055866	2
3		KIT: Mtg TO-3	04713	MK-15	100689	2
4	XF2	HOLDER: Fuse 3AG	75915	357001	102440	1
5	F2	FUSE: 5A 3AG MB	75915	312005	100582	1
6		GROMMET	83330	2148	112628	1
7		HEAT SINK: TO-3	98978	UP-TO3	100936	2
8		WASHER: Insulator Mica TO-3 P/O Q1	08289	DM-103	102940	
9	Q1	TRANSISTOR: PNP	04713	MJE2500	102889	1
10	U1	INTEGRATED CIRCUIT: Regulator 5V 1A	27014	LM309K	025787	1
11	R1	RESISTOR: Fixed Wire Wound 2 Ω 5%, 5W	35434	C5	101837	1
12	C2	CAPACITOR: Fixed Tant 1 µF 10%, 35 V	56289	150D105X9035A2	100082	1
13	C3	CAPACITOR: Fixed Tant 100 µF 20%, 10 V	56289	196D336X0025LA3	106516	1
14		LUG: Solder 4-40 Int Tooth	83330	1416-4	100509	2
15		SCREW: FHMS 4-40 x 3/8	96906	MS24693-C4	10072006	4
16		NUT: 4-40 Hex	96906	MS35649-244	100707	4
17		WASHER: #4 Split	96906	MS35338-135	100711	2
18		SCREW: PHMS 6-32 x 7/16	96906	MS51957-29	10063207	9
19		WASHER: #6 Split	96906	MS35338-136	100712	9
21		CORD: Black Trim Vinyle	81104	2481	100938	A/R
22		NUT: 6-32 Tinnerman	78553	C1887-632-4	102944	2
23		WASHER: #4 Flat	96906	MS15795-803	100703	2
24		WASHER: #6 Flat	86928	5710-23-10	100662	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION REAR PANEL ASSEMBLY 057092

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
		ASSEMBLY: Rear Panel	52542	057092	057092	1
2		FILTER: Air	52542	32000910	32000910	1
3		FILTER: Housing	52542	33000322	33000322	1
4	B1	FAN	IMC	WS2107F	106664	1
5	TB1	STRIP: Terminal	13150	13205	103859	2
6	S2	SWITCH: Slide 4-PDT	82389	47227LF	102329	1
7		RECEPTACLE: AC	82389	EAC301	101288	1
8	F1	FUSE: 3A 3AG MB	75915	312003	100587	1
9	XF1	HOLDER: Fuse 3AG	75915	340255A	102418	1
10		SCREW: PHMS 6-32 x 3/4	96906	MS51957-32	10063212	8
11		NUT: 6-32 Kep	78189	511-061800-00	112472	8
12		WASHER: #6 Flat	96906	MS15795-805	100704	8
13		WASHER: #6 Split	96906	MS35338-136	100712	4
14		SCREW: PHMS 6-32 x 5/8	96906	MS51957-31	10063210	8
15		SCREW: PHMS 4-40 x 3/8	96906	MS51957-15	10062606	2
16		WASHER: #4 Split	96906	MS35338-135	10062606	2
17		NUT: 4-40 Kep	78189	511-041800-00	100941	2
18		SCREW: PHMS 4-40 x 5/16	96906	MS51957-14	10062605	2
19		NUT: 4-40	96906	NAS671C4	100622	2
21		PLATE: Stradle	13150	1832	103860	4
22		WASHER: #4 Flat	96906	MS15795-803	100703	2
23	C1	CAPACITOR: Fixed Mylar 0.22 µF 1%, 100 V	CAPCO	MME		2
	C2	Same as C1				
24		NUT: 6-32 Capacitor	73734	8061-NP	103059	4
25		SCREEN	52542	055552	055552	2
26		CONNECTOR: 50-pin Digital Interface	02660	57-40500	101156	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION ANALOG MOTHER BOARD PC ASSEMBLY 05597101

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
		PC ASSEMBLY, ANALOG MOTHER BOARD	52542	05597101	05597101	1
	A1	PC ASSEMBLY, Source B Sign and Overvoltage	52542	05590401	05590401	1
	A2	PC ASSEMBLY, Source A Sign and Overvoltage	52542	05590401	05590401	1
	A3	PC ASSEMBLY, Source B Power Amp and Overcurrent	52542	05593801	05593801	1
	A4	PC ASSEMBLY, Source A Power Amp and Overcurrent	52542	05593801	05593801	1
	C18	CAPACITOR, Fixed Mylar: 0.1 µF 20%, 600 V	99515	D6-104	100158	2
	C19	Same as C1				
	CR1	DIODE: Rectifier 50 V	81483	30S05	103252	4
	CR2	Same as CR1				
	CR3	Same as CR1				
	CR4	Same as CR1				
4		PC BOARD	52542	055971	055971	1
7		CONNECTOR: 22-pin	05574	000221-0178	101160	8
10	S1&S2	ASSEMBLY, Pushbutton Switch	52542	055915	055915	1
13		BLOCK: 6-32 Rt Angle Mtg	88245	1590B	100489	1
30		KEY: Polar	05574	091-0024-000	100808	8

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION DIGITAL MOTHER BOARD PC ASSEMBLY 05597001

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
		PC ASSEMBLY, DIGITAL MOTHER BOARD	52542	05597001	05597001	1
	A5	PC ASSEMBLY, Source B Digital To Analog	52542	05596901	05596901	1
	A6	PC ASSEMBLY, Source A Digital To Analog	52542	05596901	05596901	1
	A7	PC ASSEMBLY, Digital Programming	52542	05569801	05569801	1
	A8	PC ASSEMBLY, Digital Input	52542	05596701	05596701	1
	A9	PC ASSEMBLY, Control and Display	52542	05593001	05593001	1
	C1	Not Used				
	C2	Not Used				
	C3	Not Used				
	C4	CAPACITOR, Fixed El Ax: 2000 µF, 15 V	00392	33C15CL252	100247	2
	C5	CAPACITOR, Fixed El Ax: 180 µF, 16 V	34553	ET221X016A6	102621	2
	C6	CAPACITOR, Fixed El Ax: 500 µF +150-10%, 50 V	00853	052HJ01X050B	100296	4
	C7	CAPACITOR, Fixed El Ax: 50 µF, 20 V	56289	TE1209	106456	4
	C8	Same as C6				
	C9	Same as C7				
	C10	Same as C4				
	C11	Same as C5				
	C12	Same as C6				
	C13	Same as C7				
	C14	Same as C6				
	C15	Same as C7				
	CR1	Not Used				
	CR2	Not Used				
	CR3	DIODE: Rectifier 600 V	04713	1N4005	100413	12
	CR4	Same as CR3				
	CR5	Same as CR3				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION DIGITAL MOTHER BOARD PC ASSEMBLY 05597001 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	CR6	Same as CR3				
	CR7	Same as CR3				
	CR8	Same as CR3				
	CR9	Same as CR3				
	CR10	Same as CR3				
	CR11	Same as CR3				
	CR12	Same as CR3				
	CR13	Same as CR3				
	CR14	Same as CR3				
34		CONNECTOR: 22-pin	05574	000221-0178	101160	8
36		CONNECTOR: 22-pin	54453	ISM220RKH-S50	102806	2
38		SOCKET: 3-pin Transistor	27264	09-52-3030	103302	6
40		BLOCK: 6-32 Rt Angle Mtg	88245	1590-B	100489	2
43		KEY: Polar	05574	091-0024-000	100808	8
45		TEST POINT: Red (+5V)	74970	105-0852-001	100541	2
46		TEST POINT: Blue (+15V)	74970	105-0860-001	100547	2
47		TEST POINT: Violet (-15V)	74970	105-0862-001	100548	2
48		TEST POINT: Black (Gnd)	74970	105-0853-001	100542	6
55		TIE: Cable	I and B	TY-24M	112488	6

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A1 & A2, SIGN & OVERVOLTAGE PC ASSEMBLY 05590401

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	A1	PC ASSEMBLY, SIGN AND OVERVOLTAGE	52542	05590401	05590401	2
	A2	Same as A1				
	C1	CAPACITOR, Fixed Tant: 15 µF 10%, 20 V	56289	150D156X9020B2	100211	6
	C2	Same as C1				
	C3	CAPACITOR, Fixed Cer Disc: .01 µF +80-20%, 100 V	91418	TA110	100103	8
	C4	Same as C3				
	C5	Same as C1				
	C6	Same as C3				
	C7	CAPACITOR, Fixed Mylar: 0.22 µF 5%, 100 V	84411	Type 663 VW	106412	1
	C8	CAPACITOR, Fixed Mylar: 0.33 µF 5%, 200 V	14752	210B1C334J	106429	1
	C9	Same as C3				
	C10	Same as C3				
	C11	CAPACITOR, Fixed Cer Disc: .01 µF 20%, 200 V	32159	4M103M	102602	1
	C12	Same as C3				
	C13	CAPACITOR, Fixed: Selected in Test				
	C14	Same as C1				
	C15	Same as C1				
	C16	Not Used				
	C17	Same as C1				
	C18	Same as C3				
	C19	CAPACITOR, Fixed Mica: 33 pF 5%, 500 V	72136	DM15ED330JO	10017501	1
	C20	Same as C3				
	CR1	Not Used				
	CR2	Not Used				
	CR3	Not Used				
	CR4	DIODE, Rectifier: 600 V	04713	1N4005	100413	8

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A1 & A2, SIGN & OVERVOLTAGE 05590401 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	CR5	Same as CR4				
	CR6	Same as CR4				
	CR7	DIODE, Signal: 50 V	03508	1N4151	100385	5
	CR8	Same as CR4				
	CR9	Same as CR4				
	CR10	Same as CR4				
	CR11	Same as CR4				
	CR12	Same as CR4				
	CR13	Same as CR7				
	CR14	Same as CR7				
	CR15	Same as CR7				
	CR16	Same as CR7				
	K1	RELAY:	Allied	MPC-4000-6V	760365	1
	K2	RELAY:	Allied	MPC-2000-6V	760363	1
	K3	RELAY:	Electrol	RA31441121	103850	4
	K4	Same as K3				
	K5	Same as K3				
	K6	Same as K3				
	Q1	TRANSISTOR, Silicon, NPN:	07263	2N3447	705071	4
	Q2	TRANSISTOR, Silicon, PNP:	07263	PN3645	101367	2
	Q3	Same as Q1				
	Q4	TRANSISTOR, Silicon, NPN:	02735	2N3440	101420	5
	Q5	Same as Q4				
	Q6	Same as Q4				
	Q7	Same as Q1				
	Q8	Same as Q4				
	Q9	Same as Q2				
	Q10	Same as Q1				
	Q11	Same as Q4				
	Q12	TRANSISTOR, Silicon, NPN:	07263	2N2219A	106587	4
	Q13	Same as Q12				
	Q14	Same as Q12				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A1 & A2, SIGN & OVERVOLTAGE 05590401 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	Q15	Same as Q12				
	R1	RESISTOR, Fixed Comp: 10 k 5%, 1 W	01121	GB1035	101591	1
	R2	Not Used				
	R3	RESISTOR, Fixed Comp: 100 Ω 5%, 1/2 W	01121	EB1015	101498	5
	R4	RESISTOR, Fixed Comp: 2.2 k 5%, 1/2 W	01121	EB2225	101454	4
	R5	RESISTOR, Fixed Wire Wound 4.5 k 3%, 3 W	15915	TS2D	630480	2
	R6	Same as R3				
	R7	Same as R4				
	R8	RESISTOR, Fixed Comp: 10 k 5%, 1/2 W	01121	EB1035	101471	2
	R9	RESISTOR, Fixed Comp: 22 k 5%, 1/2 W	01121	EB2235	101513	1
	R10	Same as R8				
	R11	RESISTOR, Fixed Comp: 1 k 5%, 1/2 W	01121	EB1025	101467	1
	R12	Same as R3				
	R13	Same as R4				
	R14	Same as R4				
	R15	Same as R5				
	R16	Same as R3				
	R17	RESISTOR, Fixed Comp: 4.7 k 5%, 1 W	01121	GB4725	101639	1
	R18	RESISTOR, Fixed Comp: 1 k 5%, 1/4 W	01121	CB1025	101569	3
	R19	RESISTOR, Fixed Comp: 470 Ω 5%, 1/4 W	01121	CB4715	101625	6
	R20	RESISTOR, Fixed Comp: 220 Ω 5%, 1/4 W	01121	CB2215	101566	3
	R21	Same as R19				
	R22	Same as R20				
	R23	RESISTOR, Fixed Film: 22.1 k 1%, 1/8 W	91637	MFF-1/8 T1	101762	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A1 & A2, SIGN & OVERVOLTAGE 05590401 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R24	RESISTOR, Fixed Film: 15 k 1%, 1/8 W	19701	MF5C-D-1502-F	101843	1
	R25	RESISTOR, Fixed Film: 30.1 k 1%, 1/8 W	91637	MMF-1/8 TL	106318	1
	R26	Same as R18				
	R27	Same as R19				
	R28	Same as R18				
	R29	Same as R20				
	R30	RESISTOR, Fixed Comp: 100 Ω 5%, 1/4 W	01121	CB1015	101609	3
	R31	Same as R19				
	R32	RESISTOR, Fixed Comp: 2.2 k 5%, 1/4 W	01121	CB2225	101562	2
	R33	Same as R19				
	R34	Same as R32				
	R35	RESISTOR, Fixed: Selected in Test				
	R36	Same as R19				
	R37	RESISTOR, Fixed Wire Wound: 20 Ω 3%, 3 W	15915	TS2D	630170	2
	R38	Same as R30				
	R39	Same as R37				
	R40	Same as R30				
	R41	RESISTOR, Fixed Film: 200 Ω 1%, 1/2 W	01121	RN65D2000F	620070	1
	R42	RESISTOR, Fixed Film: 15 k 1%, 1/2 W	01121	RN65D1502F	620627	1
	R43	Same as R4				
	R44	RESISTOR, Fixed Comp: 470 Ω 5%, 1/2 W	01121	EB4715	101539	1
	R45	RESISTOR, Variable: 5 k 10%, 1/2 W	73138	62PAR5K	101845	1
	R46	RESISTOR, Fixed Film: 10 k 1%, 1/8 W	19017	MF5C-D-1002-F	102098	1
	R47	Same as R3				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A1 & A2, SIGN & OVERVOLTAGE 05590401 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R48	RESISTOR, Fixed Comp: 4.7 Ω 5%, 1/2 W	01121	DB47G5	106015	1
	R49	RESISTOR, Fixed Film: 10 k 1%, 1/2 W	01121	RN65D1002F	620608	1
	R50	RESISTOR, Fixed Film: 20 k 1%, 1/2 W	91637	MFF-1/2 T1	102483	1
	R51	RESISTOR, Fixed Film: 40.2 k 1%, 1/8 W	19701	MF5C-D-4022-F	102148	1
	R52	RESISTOR, Fixed Film: 80.6 k 1%, 1/8 W	19701	MF5C-D-8062-F	102222	1
	U1	INTEGRATED CIRCUIT: Hex Inverter	01295	SN7404N	025779	1
	U2	INTEGRATED CIRCUIT: Quad Latch	01295	SN7475N	019710	1
	U3	INTEGRATED CIRCUIT: One-Shot Multivibrator	01295	SN74121N	025760	3
	U4	Same as U3				
	U5	Same as U3				
	U6	INTEGRATED CIRCUIT: Quad 2-Input NAND	01295	SN7400N	019705	1
	U7	INTEGRATED CIRCUIT: Opto-Isolator	50522	4N28	741011	1
	U8	INTEGRATED CIRCUIT: Operational Amplifier	27014	LM301AH	025745	1
	VR1	DIODE, Zener: 6.2 V	03877	1N753A	100387	1
	VR2	DIODE, Zener: 3.3 V	03877	1N746A	100415	1
	W1	JUMPER:	Gettig	L-2007-1	102879	1
4		PC BOARD	52542	055904	055904	1
175		HEATSINK: TO-3	13103	6103B	103856	4
176		SOCKET: Pin:	06776	PS-402-44	102430	8
177		SPACER: 4-40 x 1/8	71279	1300-9	100492	8
182		SCREW: 4-40 x 5/16	MIL	MS51957-14	10062605	
183		WASHER: #4 Split	MIL	MS35338-135	100711	

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A3 & A4, POWER AMP & OVERCURRENT PC ASSEMBLY 05593801

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	A3	PC ASSEMBLY, POWER AMP AND OVERCURRENT	52542	05593801	05593801	2
	A4	Same as A3				
	C1	CAPACITOR, Fixed Cer Disc: .01 µF 20%, 500 V	91418	TYPE SAM	100075	4
	C2	Same as C1				
	C3	Same as C1				
	C4	Same as C1				
	C5	CAPACITOR, Fixed: 2200 µF, 40 V	52542	819959	819959	2
	C6	Same as C5				
	C7	CAPACITOR, Fixed Cer Disc: 0.01 µF +80-20%, 100 V	91418	TA110	100103	4
	C8	Same as C7				
	C9	CAPACITOR, Fixed El Ax: 68 µF 10%, 63 V	34553	C437AR/H64	102597	1
	C10	CAPACITOR, Fixed Mylar: 1 µF 20%, 100 V	14752	210B1B05	100056	1
	C11	CAPACITOR, Fixed Tant: 56 µF 10%, 6 V	56289	150D566X9006B2	100225	3
	C12	Same as C11				
	C13	CAPACITOR, Fixed Mica: 33 pF 5%, 500 V	72136	DM15ED330JO	100175	2
	C14	CAPACITOR, Fixed El Ax: 100 µF +75-10%, 25 V	56289	TE1211	100165	2
	C15	Same as C11				
	C16	CAPACITOR, Fixed Mylar: 0.01 µF 10%, 200 V	56289	192P10392	100168	1
	C17	CAPACITOR, Fixed Tant: 6.8 µF 20%, 35 V	56289	150D685X9035B	100182	3
	C18	CAPACITOR, Fixed Mylar: 0.47 µF 20%, 250 V	IEC	CM4700-2	106433	1
	C19	Same as C7				
	C20	Same as C7				
	C21	CAPACITOR, Fixed El Ax: 500 µF +150-10%, 50 V	00853	052HJ501X050B	100296	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A3 & A4, POWER AMP & OVERCURRENT 05593801 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C22	Same as C17				
	C23	Same as C14				
	C24	CAPACITOR, Fixed Mica: 27 pF 5%, 500 V	72136	DM15ED270JO	102545	1
	C25	Same as C17				
	C26	Not Used				
	C27	Same as C13				
	C28	CAPACITOR, Fixed Cer Disc: 0.1 µF 20%, 50 V	56289	5C023104X0500C5	100178	1
	C29	CAPACITOR, Fixed: Selected in Test				
	C30	CAPACITOR, Fixed Mylar: 0.1 µF 10%, 100 V	99515	DE1-104E	100141	1
	C31	CAPACITOR, Fixed Tant: 15 µF 10%, 20 V	56289	150D156X9020B2	100211	1
	CR1	DIODE, Rectifier: 600 V	04713	1N4005	100413	11
	CR2	Same as CR1				
	CR3	Same as CR1				
	CR4	Same as CR1				
	CR5	DIODE, Rectifier: 50 V	81483	1N4719	100406	1
	CR6	Same as CR1				
	CR7	Same as CR1				
	CR8	DIODE, Signal: 50 V	03508	1N4151	100385	8
	CR9	Same as CR8				
	CR10	Same as CR8				
	CR11	Same as CR1				
	CR12	Same as CR8				
	CR13	Same as CR1				
	CR14	Same as CR1				
	CR15	Same as CR8				
	CR16	Same as CR8				
	CR17	Same as CR8				
	CR18	Same as CR8				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A3 & A4, POWER AMP & OVERCURRENT 05593801 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	CR19	Same as CR8				
	CR20	Same as CR1				
	CR21	Same as CR1				
	K1	RELAY:	Electrol	RA31441121	103850	4
	K2	Same as K1				
	K3	Same as K1				
	K4	Same as K1				
	Q1	TRANSISTOR, Silicon NPN:	04713	2N3738	102738	1
	Q2	TRANSISTOR, Silicon NPN	02735	2N3440	101420	3
	Q3	Same as Q2				
	Q4	TRANSISTOR, Silicon, PNP:	07263	PN3645	101367	3
	Q5	Same as Q2				
	Q6	TRANSISTOR, FET:	83781	2N4340	705069	1
	Q7	TRANSISTOR, Silicon NPN:	22229	2N4912	700196	1
	Q8	Same as Q4				
	Q9	Same as Q4				
	Q10	TRANSISTOR, FET:	04713	2N4091	101409	1
	R1	RESISTOR, Fixed Comp: 10 k 5%, 1/4 W	01121	CB1035	101570	2
	R2	Same as R1				
	R3	RESISTOR, Fixed Comp: 4.7 k 5%, 2 W	01121	HB4725	106048	1
	R4	RESISTOR, Fixed Comp: 220 Ω 5%, 1/4 W	01121	CB2215	101566	1
	R5	RESISTOR, Fixed Wire Wound: 6 k 3%, 3 W	15915	TS2D	630499	1
	R6	RESISTOR, Fixed Wire Wound: 1 Ω 3%, 3 W	15915	TS2D	630030	2
	R7	RESISTOR, Fixed Comp: 1 k 5%, 1/4 W	01121	CB1025	101562	3
	R8	RESISTOR, Fixed Comp: 3.3 k 5%, 1/4 W	01121	CB3325	101559	1
	R9	RESISTOR, Fixed Comp: 330 Ω 5%, 1/4 W	01121	CB3315	101536	4

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A3 & A4, POWER AMP & OVERCURRENT 05593801 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R10	Same as R9				
	R11	Same as R6				
	R12	RESISTOR, Variable: 500 Ω 20%, 1/2 W	80294	3329W-1-501	101965	2
	R13	RESISTOR, Fixed Film: 1.27 k 1%, 1/8 W	18612	V53-1	102237	1
	R14	RESISTOR, Fixed Comp: 8.2 k 5%, 1/4 W	01121	CB8225	101595	1
	R15	RESISTOR, Fixed Comp: 2.7 k 5%, 1/4 W	01121	CB2725	101599	1
	R16	Same as R7				
	R17	RESISTOR, Fixed Comp: 10 M 5%, 1/4 W	01121	CB1045	101564	1
	R18	RESISTOR, Fixed Comp: 3.3 M 5%, 1/4 W	01121	CB3355	101660	1
	R19	RESISTOR, Variable: 2 k 10%, 1/2 W	73138	62PAR2K	102047	1
	R20	Same as R9				
	R21	RESISTOR, Fixed Comp: 2.7 Ω 5%, 1/4 W	01121	CB27G5	101784	1
	R22	RESISTOR, Fixed Comp: 10 Ω 5%, 1/4 W	01121	CB1005	101557	1
	R23	RESISTOR, Fixed Comp: 220 Ω 5%, 1/2 W	01121	EB2215	101667	2
	R24	RESISTOR, Fixed Comp: 47 Ω 5%, 1/4 W	01121	CB4705	101560	1
	R25	RESISTOR, Fixed Comp: 3.3 k 5%, 1 W	01121	GB3325	101637	1
	R26	Same as R9				
	R27	RESISTOR, Fixed Wire Wound: 2 Ω 3%, 3 W	15915	TS2D	630060	1
	R28	RESISTOR, Fixed Comp: 470 Ω 5%, 1 W	01121	GB4715	101864	1
	R29	Same as R7				
	R30	Same as R12				
	R31	RESISTOR, Fixed Film: 5.62 k 1%, 1/8 W	91637	MFF 1/8 T1	102198	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A3 & A4, POWER AMP & OVERCURRENT 05593801 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R32	RESISTOR, Fixed Film: 6.19 k 1%, 1/8 W	91637	MFF 1/8 T1	102199	1
	R33	RESISTOR, Fixed Comp: 820 Ω 5%, 1/4 W	01121	CB8215	101567	2
	R34	RESISTOR, Fixed Comp: 56 k 5%, 1/4 W	01121	CB5635	101670	1
	R35	RESISTOR, Fixed Comp: 560 Ω 5%, 2 W	01121	HB5615	101682	1
	R36	RESISTOR, Fixed Film: 100 Ω 1%, 1/8 W	91637	MFF 1/8 T1	102086	2
	R37	Same as R23				
	R38	RESISTOR, Fixed Film: 200 Ω 1%, 1/8 W	19701	MF5C-D-2000F	103195	1
	R39	RESISTOR, Fixed Film: 402 Ω 1%, 1/8 W	01121	FN60D4020F	106320	1
	R40	RESISTOR, Fixed Film: 806 Ω 1%, 1/8 W	19701	MF5C-D-8060F	103194	1
	R41	RESISTOR, Fixed Film: 11.8 k 1%, 1/8 W	91637	MFF 1/8 T1	106215	1
	R42	RESISTOR, Fixed Comp: 100 Ω 5%, 1/4 W	01121	CB1015	101609	2
	R43	Same as R42				
	R44	RESISTOR, Fixed Comp: 6.8 k 5%, 1/4 W	01121	CB6825	101544	1
	R45	RESISTOR, Fixed: Selected in Test				
	R46	RESISTOR, Fixed Comp: 8.2 k 5%, 1/4 W	01121	CB8225	101595	1
	R47	RESISTOR, Fixed Comp: 680 Ω 5%, 1/4 W	01121	CB6815	101669	1
	R48	Same as R33				
	R49	RESISTOR, Variable: 5 k 10%, 1/2 W	73138	62PAR5K	101845	1
	R50	RESISTOR, Fixed Comp: 470 Ω 5%, 1/4 W	01121	CB4715	101625	2
	R51	RESISTOR, Fixed Comp: 1.5 k 5%, 2 W	01121	HB1525	101741	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A3 & A4, POWER AMP & OVERCURRENT 05593801 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/O
	R52	RESISTOR, Fixed Comp: 47 k 5%, 1/4 W	01121	CB4735	101574	2
	R53	Same as R52				
	R54	Same as R50				
	R55	RESISTOR, Fixed Comp: 1.5 k 5%, 1/4 W	01121	CB1525	101577	1
	U1	INTEGRATED CIRCUIT: Operational Amp (Red Dot)	52542	04532802	04532802	1
	U2	INTEGRATED CIRCUIT: Operational Amp	27014	LM301AH	025745	2
	U3	Same as U2				
	VR1	DIODE, Zener: 5.1 V	03877	1N751A	100378	3
	VR2	DIODE, Zener: 5.1 V	81483	1N4733A	720388	2
	VR3	Same as VR2				
	VR4	Same as VR1				
	VR5	DIODE, Zener: 3.3 V	03877	1N746A	100415	1
	VR6	DIODE, Zener: 5.6 V	03877	1N752A	100376	1
	VR7	DIODE, Zener: 10 V	04713	1N4740A	102873	1
	VR8	DIODE, Zener: 9 V	04713	1N938	720474	1
	VR9	Same as VR1				
	VR10	DIODE, Zener: 2.4 V	03877	1N4370	100420	1
4		PC BOARD	52542	055938	055938	1
146		HEATSINK: TO-66	13103	6168B BASE	103846	1
147		SOCKET: Pin	06776	PS-402-44	102430	4
148		SPACER: 4-40 x 1/8	71279	1300-9	100492	4
149		SCREW: PH 4-40 x 5/16	MIL	MS51957-14	10062605	4
150		WASHER, Lock: #4	MIL	MS35338-135	100711	4
153		CABLE: Tie		TY-24M	112488	3

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A5 & A6, DIGITAL TO ANALOG PC ASSEMBLY 05596901

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	A5	PC ASSEMBLY, DIGITAL TO ANALOG	52542	05596901	05596901	2
	A6	Same as A5				
	C1	CAPACITOR, Fixed Tant: 15 µF 10%, 20 V	56289	150D156X9020B2	100211	11
	C2	Same as C1				
	C3	Same as C1				
	C4	Same as C1				
	C5	Same as C1				
	C6	Same as C1				
	C7	CAPACITOR, Fixed Cer Disc: 1 µF 20%, 25 V	56289	5CZ50105X0050C5	100176	1
	C8	CAPACITOR, Fixed Mylar: .0047 µF 10%, 200 V	56289	192P47292	100129	1
	C9	CAPACITOR, Fixed: Selected in Test				
	C10	CAPACITOR, Fixed Cer Disc: 0.01 µF +80-20%, 100 V	91418	TA110	100103	9
	C11	CAPACITOR, Fixed Mica: 100 pF 5%, 500 V	72136	DM15FD101JO	10017301	1
	C12	Same as C10				
	C13	CAPACITOR, Fixed Mica: 1000 pF 5%, 100 V	72136	DM15FA102JO	10022101	1
	C14	Same as C10				
	C15	CAPACITOR, Fixed Mica: 33 pF 5%, 500 V	72136	DM15ED330JO	10017501	1
	C16	Same as C10				
	C17	Same as C10				
	C18	Same as C10				
	C19	Same as C10				
	C20	Same as C10				
	C21	Not Used				
	C22	Not Used				
	C23	Same as C10				
	C24	Same as C1				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A5 & A6, DIGITAL TO ANALOG 05596901 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	C25	Same as C1				
	C26	Same as C1				
	C27	Same as C1				
	C28	Same as C1				
	CR1	Not Used				
	CR2	Not Used				
	CR3	DIODE, Signal: 50 V	03508	1N4151	100385	8
	CR4	Same as CR3				
	CR5	Same as CR3				
	CR6	Same as CR3				
	CR7	Same as CR3				
	CR8	Same as CR3				
	CR9	Same as CR3				
	CR10	Same as CR3				
	K1	RELAY	Electrol	RA31441121	103850	2
	K2	Same as K1				
	Q1	TRANSISTOR: Silicon NPN	02735	2N3440	101420	1
	Q2	TRANSISTOR: Silicon NPN	04713	2N3904	101377	1
	R1	RESISTOR, Fixed Comp: 220 Ω 5%, 1/4 W	01121	CB2215	101566	16
	R2	Same as R1				
	R3	Same as R1				
	R4	Same as R1				
	R5	Same as R1				
	R6	Same as R1				
	R7	Same as R1				
	R8	Same as R1				
	R9	Same as R1				
	R10	Same as R1				
	R11	Same as R1				
	R12	Same as R1				
	R13	Same as R1				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A5 & A6, DIGITAL TO ANALOG 05596901 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R14	Same as R1				
	R15	Same as R1				
	R16	Same as R1				
	R17	RESISTOR: Fixed Comp 10 k 5%, 1/4 W	01121	CB1035	101570	19
	R18	Same as R17				
	R19	Same as R17				
	R20	Same as R17				
	R21	Same as R17				
	R22	Same as R17				
	R23	Same as R17				
	R24	Same as R17				
	R25	Same as R17				
	R26	Same as R17				
	R27	Same as R17				
	R28	Same as R17				
	R29	Same as R17				
	R30	Same as R17				
	R31	Same as R17				
	R32	Same as R17				
	R33	RESISTOR: Variable 100 Ω 10%, 1/2 W	73138	62PAR100	101992	1
	R34	RESISTOR: Fixed Film 17.4 k 1%, 1/8 W	19701	MF5C-D-1742-F	103847	1
	R35	RESISTOR: Fixed Film 402 k 1%, 1/8 W	19701	MF5C-D-4023-F	102168	1
	R36	RESISTOR: Fixed Film 100 k 1%, 1/8 W	96906	RN60E1003F	101967	1
	R37	RESISTOR: Fixed Comp 1 k 5%, 1/4 W	01121	CB1025	101569	5
	R38	Same as R37				
	R39	RESISTOR: Fixed Selected in Test				
	R40	RESISTOR: Fixed Film 21 k 1%, 1/8 W	19701	MF5C-D-2102-F	103848	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A5 & A6, DIGITAL TO ANALOG 05596901 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R41	RESISTOR, Fixed Comp: 100 Ω 5%, 1/4 W	01121	CB1015	101609	1
	R42	RESISTOR, Fixed Comp: 33 Ω 5%, 1/4 W	01121	CB3305	101731	1
	R43	RESISTOR, Fixed Comp: 820 Ω 5%, 1/4 W	01121	CB8215	101567	1
	R44	RESISTOR, Fixed Comp: 680 Ω 5%, 1/4 W	01121	CB6815	101669	1
	R45	Not Used				
	R46	RESISTOR, Fixed Film: 698 Ω 1%, 1/8 W	15915	TS2D	620233	1
	R47	RESISTOR, Fixed Film: 196 k 1%, 1/8 W	81349	RN60E1963F	102295	1
	R48	Not Used				
	R49	RESISTOR, Fixed Film: 90 k 1%, 1/8 W	81349	FN60D9002F	106327	1
	R50	RESISTOR, Fixed Film: 10 k 1%, 1/8 W	19701	MF5C-D1002-F	102098	1
	R51	RESISTOR, Fixed Film: 9.09 k 1%, 1/8 W	19701	MF5C-D9091-F	102157	1
	R52	Same as R17				
	R53	Same as R17				
	R54	RESISTOR, Fixed Comp: 8.2 k 5%, 1/4 W	01121	CB8225	101595	1
	R55	Same as R44				
	R56	Same as R44				
	R57	Same as R37				
	R58	RESISTOR, Fixed Comp: 1.5 k 5%, 1/4 W	01121	CB1525	101577	1
	R59	Same as R37				
	R60	RESISTOR, Fixed Comp: 22 k 5%, 1/4 W	01121	CB2235	101572	1
	R61	Same as R17				
	R62	RESISTOR, Fixed Film: 1 k 1%, 1/8 W	19701	MF5C-D-1001-F	102097	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A5 & A6, DIGITAL TO ANALOG 05596901 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U1	INTEGRATED CIRCUIT: TTL BCD-Dec Decoder	01295	SN7442N	025749	1
	U2	INTEGRATED CIRCUIT: TTL Binary Counter	18324	N8281A	025727	4
	U3	Same as U2				
	U4	Same as U2				
	U5	Same as U2				
	U6	INTEGRATED CIRCUIT: Opto-Isolator	50522	4N28	741011	18
	U7	Same as U6				
	U8	Same as U6				
	U9	Same as U6				
	U10	Same as U6				
	U11	Same as U6				
	U12	Same as U6				
	U13	Same as U6				
	U14	Same as U6				
	U15	Same as U6				
	U16	Same as U6				
	U17	Same as U6				
	U18	Same as U6				
	U19	Same as U6				
	U20	Same as U6				
	U21	Same as U6				
	U22	INTEGRATED CIRCUIT: Digital-Analog-Converter	50721	DAC169-160	103849	1
	U23	INTEGRATED CIRCUIT: Operational Amp (Red Dot)	52542	04532802	04532802	1
	U24	INTEGRATED CIRCUIT: Operational Amp	27014	LM301AH	025745	3
	U25	Same as U24				
	U26	Same as U24				
	U27	Same as U6				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A5 & A6, DIGITAL TO ANALOG 05596901 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U28	INTEGRATED CIRCUIT: NAND Quad 2-Input	01295	SN7400N	019705	1
	U29	Same as U6				
	VR1	DIODE: Zener 6.2 V	04713	1N823	720461	2
	VR2	Same as VR1				
	VR3	DIODE: Zener 13 V	04713	1N964B	100412	1
3		PC BOARD	52542	055969	055969	1
148		SOCKET: Pin	00779	7-330808-4	101281	27
149		SPACER: 4-40	06540	9536B-A-0440-17	101062	2
150		SHIELD:	52542	065018	065018	1
151		SCREW: PHMS 4-40 x 1/4	MIL	MS51957-13	10062604	2
152		WASHER: Flat #4	MIL	MS15795-805	100703	2
153		WASHER: Lock	MIL	MS35338-135	100711	2

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A7, DIGITAL PROGRAMMING PC ASSEMBLY 05596801

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	A7	PC ASSEMBLY, DIGITAL PROGRAMMING	52542	05596801	05596801	1
	C1	CAPACITOR, Fixed Tant: 22 µF 10%, 15 V	56289	150D226X9015B2	100125	1
	C2	CAPACITOR, Fixed Mylar: 0.01 µF 10%, 100 V	27556	ZA2C103K	106410	1
	C3	CAPACITOR, Fixed Cer Disc: 0.01 µF +80-20%, 100 V	91418	TA110	100103	1
	C4	CAPACITOR, Fixed Tant: 15 µF 10%, 20 V	56289	150D156X9020B2	100211	1
	C5	CAPACITOR, Fixed Tant: 1 µF 10%, 35 V	56289	150D105X9035A2	100082	1
	C6	CAPACITOR, Fixed Cer Disc: 1 µF 20%, 50 V	56289	5CZ50105X0050C5	100176	1
	Q1	TRANSISTOR: Silicon NPN	04713	2N3904	101377	1
	R1	RESISTOR, Fixed Comp: 1 k 5%, 1/4 W	01121	CB1025	101569	2
	R2	RESISTOR, Fixed Comp: 4.7 k 5%, 1/4 W	01121	CB4725	101598	1
	R3	Same as R1				
	R4	RESISTOR, Fixed Comp: 10 k 5%, 1/4 W	01121	CB1035	101570	2
	R5	RESISTOR, Fixed Comp: 47 k 5%, 1/4 W	01121	CB4735	101574	1
	R6	Same as R4				
	R7	RESISTOR, Fixed Comp: 470 Ω 5%, 1/4 W	01121	CB4715	101625	1
	R8	RESISTOR, Fixed Comp: 2.2 k 5%, 1/4 W	01121	CB2225	101562	1
	R9	RESISTOR, Fixed Comp: 3.3 k 5%, 1/4 W	01121	CB3325	101559	1
	U1	INTEGRATED CIRCUIT: Timer Wide Range	18324	NE555V	045208	1
	U2	INTEGRATED CIRCUIT: TTL Binary Counter	18324	N8281A	025727	15
	U3	INTEGRATED CIRCUIT: TTL 8-Bit Data Select	01295	SN74151N	025771	4
	U4	Same as U3				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A7, DIGITAL PROGRAMMING 05596801 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U5	Same as U3				
	U6	Same as U3				
	U7	Same as U2				
	U8	Same as U2				
	U9	Same as U2				
	U10	Same as U2				
	U11	Same as U2				
	U12	Same as U2				
	U13	Same as U2				
	U14	Same as U2				
	U15	Same as U2				
	U16	Same as U2				
	U17	Same as U2				
	U18	Same as U2				
	U19	Same as U2				
	U20	Same as U2				
	U21	INTEGRATED CIRCUIT: TTL Dual D Flip-Flop	01295	SN7474N	025241	1
	U22	INTEGRATED CIRCUIT: TTL Triple 3-Input AND	04713	MC3006P	045219	1
	U23	INTEGRATED CIRCUIT: TTL Quad 2-Input Exlclusive OR	04713	MC3021P	025789	1
	U24	INTEGRATED CIRCUIT: TTL Hex Inverter	01295	SN7404N	025779	2
	U25	Same as U24				
	U26	INTEGRATED CIRCUIT: TTL Hex Inverter	01295	SN7417N	106629	4
	U27	Same as U26				
	U28	Same as U26				
	U29	Same as U26				
	U30	INTEGRATED CIRCUIT: TTL Hex Inverter	01295	SN7416N	045230	2
	U31	Same as U30				
4		PC BOARD	52542	055968	055968	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A8, DIGITAL INPUT PC ASSEMBLY 05596701

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	A8	PC ASSEMBLY, DIGITAL INPUT	52542	05596701	05596701	1
	C1	CAPACITOR, Fixed Mica: 1000 pF 5%, 100 V	72136	DM15FA102JO	10024301	1
	C2	CAPACITOR, Fixed Tant: 15 µF 10%, 20 V	56289	150D156X9020B2	100211	2
	C3	CAPACITOR, Fixed Tant: 1 µF 10%, 35 V	56289	150D105X9035A2	100082	2
	C4	Same as C3				
	C5	CAPACITOR, Fixed Cer Disc: 0.01 µF 20%, 100 V	91418	TA110	100103	3
	C6	Same as C5				
	C7	Same as C2				
	C8	Same as C5				
	CR1	DIODE, Signal: 50 V	03508	1N4151	100385	1
	R1	RESISTOR, Fixed Comp: 22 k 5%, 1/4 W	01121	CB2235	101572	2
	R2	RESISTOR, Fixed Comp: 470 Ω 5%, 1/4 W	01121	CB4715	101625	1
	R3	Same as R1				
	R4	RESISTOR, Fixed Comp: 27 Ω 5%, 1/4 W	01121	CB2705	101729	1
	U1	INTEGRATED CIRCUIT: TTL Hex Schmitt Trigger Inverter	01295	SN7417N	106629	1
	U2	INTEGRATED CIRCUIT: TTL Quad 2-Input NAND	01295	SN7400N	019705	3
	U3	Same as U2				
	U4	Same as U2				
	U5	INTEGRATED CIRCUIT: TTL Quad 2-Input AND	01295	SN7408N	103093	9
	U6	Same as U5				
	U7	Same as U5				
	U8	Same as U5				
	U9	Same as U5				
	U10	Same as U5				
	U11	Same as U5				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A8, DIGITAL INPUT PC ASSEMBLY 05596701 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U12	Same as U5				
	U13	INTEGRATED CIRCUIT: TTL Hex Inverter	01295	SN7404N	025779	1
	U14	INTEGRATED CIRCUIT: TTL 9-Bit Odd/Even Parity	01295	SN74180N	103851	2
	U15	Same as U14				
	U16	INTEGRATED CIRCUIT: TTL Quad 2-1 Data Select	01295	SN74157N	045242	7
	U17	Same as U16				
	U18	Same as U16				
	U19	Same as U16				
	U20	Same as U16				
	U21	Same as U16				
	U22	Same as U16				
	U23	INTEGRATED CIRCUIT: TTL Dual Mono Multivibrator	01295	SN74123N	045209	1
	U24	INTEGRATED CIRCUIT: TTL BCD-Decimal Decoder	01295	SN7442N	025749	1
	U25	INTEGRATED CIRCUIT: TTL Quad 2-Input Exclusive OR	04713	MC3021P	025789	3
	U26	Same as U25				
	U27	Same as U25				
	U28	INTEGRATED CIRCUIT: TTL 8-Input NAND	01295	SN7430N	025726	2
	U29	Same as U28				
	U30	INTEGRATED CIRCUIT: TTL Quad 2-Input OR	01295	SN7432N	045257	1
	U31	INTEGRATED CIRCUIT: Resistor Module 5 k	52542	027867	027867	18
	U32	Same as U31				
	U33	Same as U31				
	U34	Same as U31				
	U35	Same as U31				
	U36	Same as U31				
	U37	Same as U31				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A8, DIGITAL INPUT PC ASSEMBLY 05596701 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U38	Same as U31				
	U39	Same as U31				
	U40	Same as U31				
	U41	Same as U31				
	U42	Same as U31				
	U43	Same as U31				
	U44	Same as U31				
	U45	Same as U31				
	U46	Same as U31				
	U47	Same as U31				
	U48	Same as U31				
	U49	Same as U5				
4		PC BOARD	52542	055967	055967	1
88		SADDLE, Cable:	06383	TM1S6	102748	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A9, CONTROL AND DISPLAY PC ASSEMBLY 05593001

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	A9	PC ASSEMBLY, DISPLAY	52542	05593001	05593001	1
	DS1	INDICATOR: Display	50522	MAN3630	103852	8
	DS2	INDICATOR: Display	50522	MAN3610	103315	2
	DS3	Same as DS1				
	DS4	Same as DS1				
	DS5	Same as DS1				
	DS6	Same as DS2				
	DS7	Same as DS1				
	DS8	Same as DS1				
	DS9	Same as DS1				
	DS10	Same as DS1				
	Q1	TRANSISTOR: Silicon PNP	07263	PN3645	101367	8
	Q2	Same as Q1				
	Q3	Same as Q1				
	Q4	Same as Q1				
	Q5	Same as Q1				
	Q6	Same as Q1				
	Q7	Same as Q1				
	Q8	Same as Q1				
	R1	RESISTOR, Fixed Comp: 27 Ω 5%, 1/4 W	01121	CB2705	101729	11
	R2	Same as R1				
	R3	Same as R1				
	R4	Same as R1				
	R5	Same as R1				
	R6	Same as R1				
	R7	Same as R1				
	R8	Same as R1				
	R9	Same as R1				
	R10	Same as R1				
	R11	Same as R1				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A9, CONTROL AND DISPLAY PC ASSEMBLY 05593001 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R12	RESISTOR, Fixed Comp: 1 k 5%, 1/4 W	01121	CB1025	101569	8
	R13	RESISTOR, Fixed Comp: 4.7 k 5%, 1/4 W	01121	CB4725	101598	8
	R14	Same as R12				
	R15	Same as R13				
	R16	Same as R12				
	R17	Same as R13				
	R18	Same as R12				
	R19	Same as R13				
	R20	Same as R12				
	R21	Same as R13				
	R22	Same as R12				
	R23	Same as R13				
	R24	Same as R12				
	R25	Same as R13				
	R26	Same as R12				
	R27	Same as R13				
	R28	RESISTOR, Fixed Comp: 270 Ω 5%, 1/4 W	01121	CB2715	101542	4
	R29	Same as R28				
	R30	Same as R28				
	R31	Same as R28				
	R32	RESISTOR, Variable: 100 k 20%, 1/2 W	80294	3339H-1-104	102298	2
	R33	Same as R32				
	R34	RESISTOR, Variable: 1 k 20%, 1/2 W	80294	3339H-1-102	103116	2
	R35	Same as R34				
	S1	SWITCH: Rocker 4-position	00779	3-435166-9	103854	6
	S2	Same as S1				
	S3	SWITCH: Slide	79727	G-111-SPDT	102325	4
	S4	Same as S3				
	S5	Same as S1				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION A9, CONTROL AND DISPLAY PC ASSEMBLY 05593001 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	S6	Same as S1				
	S7	Same as S1				
	S8	Same as S1				
	S9	SWITCH: Rocker 5-position	00779	4-435166-0	103855	2
	S10	Same as S9				
	S11	SWITCH: Pushbutton	31918	SR 12.3x17.1MM	103853	1
	S12	Same as S3				
	S13	Same as S3				
	U1	INTEGRATED CIRCUIT: TTL BCD-Decoder Driver	01295	SN74247N	103314	1
	U2	INTEGRATED CIRCUIT: TTL Decoder/Driver	01295	SN74145N	025754	1
4		PC BOARD	52542	055930	055930	1
85		SOCKET: 14-pin Dip WW	73803	C91-14-50	102928	10
87		SPACER: Swage 4-40 x 1/8	71279	1300-11	100537	2
90		PANEL: Local Program	52542	055902	055902	1
93		SCREW: PHM 4-40 x 5/16	MIL	MS51957-14	10062605	2
94		WASHER: Split #4	MIL	MS35338-135	100711	2

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION OPTION 01 IEEE-488 ASSEMBLY 05733501

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
1	A8	PC ASSEMBLY, OPTION 01 INPUT	52542	05726301	05726301	1
2		ASSEMBLY, CABLE	52542	05732101	05732101	1
		CONNECTOR: 5-pin	27264	03-06-2055	101263	1
		CONNECTOR: Terminal	27264	02-06-2103	10282202	5
		PLATE: Adapter	52542	057231	057231	1
		STUDS: Metric	52542	057361	057361	2
		CABLE ASSEMBLY			05732101	REF
1	J101	CONNECTOR: 24-pin	02660	57-20420-2	117054	1
2	J102	CONNECTOR: 5-pin	27264	03-06-1055	101264	1
5		LUG: Ground #4	83330	1416-4	100509	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION OPTION 01 IEEE-488 INPUT PC ASSEMBLY 05726301

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	OPT. 01 A8	PC ASSEMBLY, OPTION 01 INPUT	52542	05726301	05726301	1
	C1	CAPACITOR, Fixed Mica: 1000 pF 5%, 100 V	72136	DM15FA102JO	10024301	2
	C2	Same as C1				
	C3	CAPACITOR, Fixed Tant: 39 µF 10%, 10 V	56289	150D396X9010B2	100183	1
	C4	CAPACITOR, Fixed Mica: 330 pF 5%, 500 V	72136	DM15FD331JO	10027601	1
	C5	CAPACITOR, Fixed Tant: 1 µF 10%, 35 V	56289	150D105X9035A2	100082	1
	C6	CAPACITOR, Fixed Tant: 15 µF 10%, 20 V	56289	150D156X9020B2	100211	1
	C7	CAPACITOR, Fixed Cer Disc: 0.05 µF +80-20%, 10 V	71590	UK10-503	100122	7
	C8	Same as C7				
	C9	Same as C7				
	C10	Same as C7				
	C11	Same as C7				
	C12	Same as C7				
	C13	Same as C7				
	CR1	DIODE: Signal 50 V	03508	1N4151	100385	1
	R1	RESISTOR, Fixed Comp: 3 k 5%, 1/4 W	01121	CB3025	101548	16
	R2	RESISTOR, Fixed Comp: 6.2 k 5%, 1/4 W	01121	CB6225	101608	16
	R3	Same as R1				
	R4	Same as R2				
	R5	Same as R1				
	R6	Same as R2				
	R7	Same as R1				
	R8	Same as R2				
	R9	Same as R1				
	R10	Same as R2				
	R11	Same as R1				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION OPTION 01 IEEE-488 INPUT PC ASSEMBLY 05726301 (Contd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R12	Same as R2				
	R13	Same as R1				
	R14	Same as R2				
	R15	Same as R1				
	R16	Same as R2				
	R17	Same as R1				
	R18	Same as R2				
	R19	Same as R1				
	R20	Same as R2				
	R21	Same as R1				
	R22	Same as R2				
	R23	Same as R1				
	R24	Same as R2				
	R25	Same as R1				
	R26	Same as R2				
	R27	Same as R1				
	R28	Same as R2				
	R29	Same as R1				
	R30	Same as R2				
	R31	Same as R1				
	R32	Same as R2				
	R33	RESISTOR, Fixed Comp: 12 k 5%, 1/4 W	01121	CB1235	101565	5
	R34	RESISTOR, Fixed Comp: 22 k 5%, 1/4 W	01121	CB2235	101572	4
	R35	Same as R34				
	R36	Same as R34				
	R37	Same as R34				
	R38	RESISTOR, Fixed Comp: 4.7 k 5%, 1/4 W	01121	CB4725	101598	1
	R39	Same as R33				
	R40	RESISTOR, Fixed Comp: 470 Ω 5%, 1/4 W	01121	CB4715	101630	1

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION OPTION 01 IEEE-488 INPUT PC ASSEMBLY 05726301 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	R41	Same as R33				
	R42	Same as R33				
	R43	Same as R33				
	U1	INTEGRATED CIRCUIT: TTL Hex Inverter Schmitt Trigger	01295	SN7414N	117078	2
	U2	Same as U1				
	U3	INTEGRATED CIRCUIT: TTL Triple 3-Input NAND Gate	01295	SN7410N	019706	3
	U4	INTEGRATED CIRCUIT: TTL Quad 2-Input OR Gate	01295	SN7432N	045257	3
	U5	INTEGRATED CIRCUIT: TTL 5-Bit Comparator	07263	F93L24	117020	1
	U6	INTEGRATED CIRCUIT: TTL 8-Input NAND Gate	01295	SN7430N	025726	1
	U7	INTEGRATED CIRCUIT: TTL Hex Inverter	01295	SN7404N	025779	3
	U8	INTEGRATED CIRCUIT: TTL Quad 2-Input AND Gate	01295	SN7408N	103093	4
	U9	INTEGRATED CIRCUIT: TTL Dual 4-Input NAND Gate	01295	SN7420N	025713	1
	U10	Not Used				
	U11	INTEGRATED CIRCUIT: TTL Quad 2-Input NAND Gate	01295	SN7400N	019705	2
	U12	Same as U7				
	U13	Same as U11				
	U14	INTEGRATED CIRCUIT: TTL Hex Buffers/Drivers	01295	SN7417N	106629	2
	U15	INTEGRATED CIRCUIT: TTL Dual D Flip-Flop	01295	SN7474N	025241	2
	U16	INTEGRATED CIRCUIT: TTL Dual Mono Multivibrator	01295	SN74123N	045209	2
	U17	Same as U14				
	U18	Same as U4				
	U19	Same as U15				
	U20	Same as U16				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION OPTION 01 IEEE-488 INPUT PC ASSEMBLY 05726301 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U21	INTEGRATED CIRCUIT: TTL BCD-To-Decimal Decoder	01295	SN7442N	025749	2
	U22	INTEGRATED CIRCUIT: TTL 4-Bit Binary Counter	18324	N8281A	025727	8
	U23	Same as U21				
	U24	Same as U8				
	U25	Same as U8				
	U26	Same as U8				
	U27	Same as U3				
	U28	Same as U22				
	U29	Same as U22				
	U30	Same as U22				
	U31	Same as U22				
	U32	Same as U22				
	U33	Same as U22				
	U34	Same as U22				
	U35	INTEGRATED CIRCUIT: TTL Quad 2-To-1 Line Data Select	01295	SN74157N	045242	7
	U36	Same as U35				
	U37	Same as U35				
	U38	Same as U35				
	U39	Same as U35				
	U40	Same as U35				
	U41	Same as U35				
	U42	Same as U4				
	U43	Same as U7				
	U44	INTEGRATED CIRCUIT: Resistor Module 12 k	52542	045008	045008	9
	U45	Same as U44				
	U46	Same as U44				
	U47	Same as U44				
	U48	Same as U44				
	U49	Same as U44				

REPLACEABLE PARTS LIST

EQUIPMENT/ASSEMBLY DESIGNATION OPTION 01 IEEE-488 INPUT PC ASSEMBLY 05726301 (Cont'd)

ITEM	REF	COMPONENT DESCRIPTION	MFR'S CODE	MANUFACTURER'S PART NUMBER	SD STOCK NUMBER	T/Q
	U50	Same as U44				
	U51	Same as U44				
4		PC BOARD	52542	057263	057263	1

CHAPTER 8

IEEE-488 INTERFACE OPTION 01

8.1 OPTION 01 PHYSICAL CONFIGURATION

When the IEEE-488 Interface Option is installed, the standard Digital Input PCB Assembly A8 is replaced by the Option 01 IEEE-488 Input PCB Assembly A8 (OPT 01). The Rear Panel Digital Interface Connector is replaced by a IEEE-488 24-pin meteric dimensioned connector J101. A 5-pin Molex connector J102 is also added to the Rear Panel to facilitate the output of the four flag signals.

8.2 OPTION 01 FUNCTIONAL OPERATION

When the Option 01 is configured, the DPSD-50 is remotely addressed and controlled by 16 active lines of the IEEE-488 24-pin interface. Table 8-1 provides the J101 pin designations for the IEEE-488 Interface.

TABLE 8-1 IEEE-488 INTERFACE CONNECTOR

PIN	IEEE-488 MINEMONIC	DPSD-50 FUNCTION
1	DIO1	DATA INPUT BIT 1
2	DIO2	DATA INPUT BIT 2
3	DIO3	DATA INPUT BIT 3
4	DIO4	DATA INPUT BIT 4
5	EOI	Not Used
6	DAV	DATA VALID INPUT
7	NRFD	READY FOR DATA OUTPUT
8	NDAC	DATA ACCEPTED OUTPUT
9	IFC	INTERFACE CLEAR INPUT
10	SRQ	Not Used
11	ATN	ATTENTION INPUT
12	SYSTEM GROUND	SYSTEM GROUND
13	DIO5	DATA INPUT BIT 5
14	DIO6	DATA INPUT BIT 6
15	DIO7	DATA INPUT BIT 7
16	DIO8	Not Used
17	REN	REMOTE ENABLE INPUT
18	DIGITAL GROUND	DIGITAL GROUND
19	DIGITAL GROUND	DIGITAL GROUND
20	DIGITAL GROUND	DIGITAL GROUND
21	DIGITAL GROUND	DIGITAL GROUND
22	DIGITAL GROUND	DIGITAL GROUND
23	DIGITAL GROUND	DIGITAL GROUND
24	DIGITAL GROUND	DIGITAL GROUND

Table 8-2 provides the pin designations for the Flag output Rear Panel connector J102.

TABLE 8-2 J102 FLAG CONNECTOR

PIN	FUNCTION
1	B SOURCE O.I FLAG
2	A SOURCE READY FLAG
3	A SOURCE O.I FLAG
4	B SOURCE READY FLAG
5	DIGITAL GROUND

The IEEE-488 Multiline Interface Messages relate to ASCII code, Table 8-3 provides the IEEE-488 DIO BIT to ASCII Character Code.

TABLE 8-3 IEEE-488 DIO CODE TO ASCII CHARACTER

IEEE-488 DIO BIT 7	6	5	4	3	2	1	ASCII CHARACTER
0	1	1	0	0	0	0	0
0	1	1	0	0	0	1	1
0	1	1	0	0	1	0	2
0	1	1	0	0	1	1	3
0	1	1	0	1	0	0	4
0	1	1	0	1	0	1	5
0	1	1	0	1	1	0	6
0	1	1	0	1	1	1	7
0	1	1	1	0	0	0	8
0	1	1	1	0	0	1	9
0	1	1	1	0	1	0	:
0	1	1	1	0	1	1	;
0	1	1	1	1	0	0	<
0	1	1	1	1	0	1	=
0	1	1	1	1	1	0	>
0	1	1	1	1	1	1	?
1	0	0	0	0	0	0	@
1	0	0	0	0	0	1	A
1	0	0	0	0	1	0	B
1	0	0	0	0	1	1	C
1	0	0	0	1	0	0	D
1	0	0	0	1	0	1	E
1	0	0	0	1	1	0	F

TABLE 8-3 IEEE-488 DIO CODE TO ASCII CHARACTER (Cont'd)

IEEE-488 DIO BIT 7	6	5	4	3	2	1	ASCII CHARACTER
1	0	0	0	1	1	1	G
1	0	0	1	0	0	0	H
1	0	0	1	0	0	1	I
1	0	0	1	0	1	0	J
1	0	0	1	0	1	1	K
1	0	0	1	1	0	0	L
1	0	0	1	1	0	1	M
1	0	0	1	1	1	0	N
1	0	0	1	1	1	1	O

The operation of the DPSD-50 when remotely controlled by the IEEE-488 Interface, is defined as a "Listener" only and its behavior is in accordance with the following IEEE-488 Subsets;

AH-1	LE-0	SH-0
DC-0	PP-0	SR-0
DT-0	RL-2	T-0
L-2	SH-0	TE-0

To address the DPSD-50 place the Front Panel REMOTE-LOCAL switch to its REMOTE position and then insert the address on the Front Panel ADDRESS A five bit 16-8-4-2-1 binary coded address switches. Seven bits of DIO and the ATN line is then used to obtain remote control of the selected address. The DIO7 and DIO6 lines of the IEEE-488 address function is used to distinguish between a "listening" device and a "talking" device. Since the DPSD-50 is a "listener". its address code will always begin with a "01" DIO7 and DIO6, followed by the five bits that represent the address.

When the DPSD-50 is turned on by the Front Panel POWER switch, it awakens in a unaddress state, and all its input and storage registers are reset to zero.

Both A & B sources of the DPSD-50 are bipolar (+ or -) with two selectable output voltage ranges (X1 and X0.1). The polarity (SIGN) and the RANGE of either source may be changed at anytime during the program, but, on a RANGE or SIGN change the programmed OUTPUT VOLTAGE will reset to zero. To obtain the desired output voltage the output voltage registers (MSD, NMSD, NLSD and LSD) may be reprogrammed and strobed again, or merely strobed if the interim registers are still programmable to the desired level. A single ASCII character code is used to program the RANGE and SIGN of the two DPSD-50 sources. Table 8-4 provides the RANGE and ISGN ASCII code.

TABLE 8-4 RANGE AND SIGN ASCII CODE

ASCII CHARACTER	RANGE/SIGN	OUTPUT VOLTAGE
0	X1/-	-10 to -50 Vdc
1	X1/+	+10 to +50 Vdc
2	X0.1/-	-0 to -9.9 Vdc
3	X0.1/+	+0 to +9.9 Vdc

Each source (A or B) of the DPSD-50 can be programmed as to overvoltage (OV) and overcurrent (OI) in 16 descrete levels to protect its load. These 16 nominal OV and OI levels are programmed by a single ASCII character, and set into separate storage registers. Table 8-5 provides the ASCII character that relates to the OV and OI programmable levels.

TABLE 8-5 OVERVOLTAGE AND OVERCURRENT LEVELS ASCII CODING

ASCII CHARACTER	OVERVOLTAGE TRIP POINT (Vdc)	OVERCURRENT LIMIT LEVEL (Amperes)
0	5.2	0.03
1	8.6	0.11
2	11.9	0.18
3	15.3	0.25
4	18.8	0.32
5	22.2	0.39
6	25.6	0.47
7	29.0	0.54
8	32.4	0.62
9	35.8	0.69
:	39.1	0.75
;	42.5	0.82
<	46.0	0.89
=	49.4	0.96
>	52.8	1.03
?	56.0	1.10

When the overcurrent level is exceeded the power source will continue to regulate, but its output current will be limited to the programmed OI level. The Front Panel OVERCURRENT indicator lamp of the appropriate source will illuminate and the OI Flag signal on the Rear Panel connector J102 will go to a logic high to indicate an overcurrent condition (A OI FLAG on pin 4 or B OI FLAG on pin 1).

When the overvoltage circuit trips, the output voltage of the effected source will drop to ≈one volt (the voltage drop across the SCR "crowbar"), and the Front Panel DC AMPERES meter will indicate the current flowing through the tripped OV SCR and

any shunt load connected to the source. To reset after a overvoltage trip the output voltage must be programmed to zero volts to reset the effected source, and then reprogrammed to the desired output voltage level.

8.2.1 Programming and Internal IEEE-488 Input A8 Assembly Functional Operation

The following discussion is referenced to Figure 6-17 Option 01 IEEE-488 Input A8 Assembly Schematic Diagram #05726301B located in Chapter 6 of this manual, and supported by the related tables located in this chapter.

Table 8-6 provides the relationship of the IEEE-488 inputs upon the internal logic operations of the A8 Option 01 PCB Assembly. It also provides the proper program format as to ASCII character inputs (refer to Table 8-3 for DIO bit to ASCII character conversion).

TABLE 8-6 PROGRAM FORMAT AND INTERNAL LOGIC OPERATIONS

ASCII CHARACTER	A8 OPT 1 PCB ASSEMBLY INTERNAL OPERATION
A	Store next numeric data in Polarity/Range Register A8U28.
0→3	Load Polarity/Range Register A8U28.
B	Store next numeric data in Overcurrent Register A8U29.
0→?	Load Overcurrent Register A8U29.
C	Store next numeric data into Overvoltage Register A8U30.
0→?	Load Overvoltage Register A8U30.
D	Store next output voltage numeric data into MSD Register A8U31.
0→9	Load output voltage MSD Register A8U31.
E	Store next output voltage numeric data into NMSD Register A8U32.
0→9	Load output voltage NMSD Register A8U32.
F	Store next output voltage numeric data into NLSD Register A8U33
0→9	Load output voltage NLSD Register A8U33.
G	Store next output voltage numeric data into LSD Register A8U34
0→9	Load output voltage LSD Register A8U34.
H	Generate Source A output voltage Strobe (SAV) at AND Gate A8U24-6. Strobe contants of Registers A8U31 through A8U34 into Registers A7U7 through A7U10.
I	Generate Source A overvoltage Strobe (SAOV) at AND Gate A8U24-3. Strobe contents of A8U30 into A7U15.
J	Generate Source A overcurrent Strobe (SAOI) at AND Gate A8U24-11. Strobe contents of A8U29 into A7U16.

TABLE 8-6 PROGRAM FORMAT AND INTERNAL LOGIC OPERATIONS (Cont'd)

ASCII CHARACTER	A8 OPT 1 PCB ASSEMBLY INTERNAL OPERATION
K	Generate Source A Range/Polarity Strobe (SA RANGE/POL) at AND Gate A8U24-8. Strobe contents of A8U28 into A7U19.
L	Generate Source B output voltage Strobe (SBV) at AND Gate A8U25-6. Strobe contents of A8U21 through A8U24 into A7U11 through A7U14.
M	Generate Source B overvoltage Strobe (SBOV) at AND Gate A8U25-3. Strobe contents of A8U30 into A7U17.
N	Generate Sourve B overcurrent Strobe (SBOI) at AND Gate A8U25-8. Strobe contents of A8U29 into A7U18.
O	Generate Source B Range/Polarity Strobe (SB RANGE/POL) at AND Gate A8U25-11. Strobe contents of A8U28 into A7U20.

A program example is provided as follows; to set up Source B for a +48 volt output, at a current limit of 0.5 amperes and a overvoltage trip point of 53 volts. First the DPSD-50 would be addressed by setting the Front Panel A ADDRESS 16-8-4-2-1 binary switches to the desired address, and then the IEEE-488 input would enter 01 followed by five bits that represent the selected address. Upon completion of the address function the following ASCII command and numeric data is entered in the following sequence.

TABLE 8-7 PROGRAM EXAMPLE

ASCII COMMAND	ASCII DATA	OPERATIONAL FUNCTION
A	1	X1 Range, + Sign.
B	7	Overcurrent limit 0.54 amperes.
C	>	Overvoltage trip point 52.8 volts.
D	4	Output voltage MSD set to 4 (4×10^{-1}).
E	8	Output voltage NMSD set to 8 (8×10^{-0}).
F	0	Output voltage NLSD set to 0 (0×10^{-1}).
G	0	Output voltage LSD set to 0 (0×10^{-2}).
O		Generate SB RANGE/POL Strobe and enter Range/Sign data into Register A7U19.
M		Generate SBOV Strobe and enter overvoltage data into Register A7U17.
N		Generate SBOI Strobe and enter overcurrent data into Register A7U18.
L		Generate SBV Strobe and enter output voltage data into Registers A7U11, A7U12, A7U13 and A7U14.

8.3 COMPONENT LOCATION AND PARTS LISTS

The component location of the A8 OPT 1 PCB Assembly is provided by Figure 6-16 Option 01 IEEE-488 Input PCB Assembly Drawing #05726301B located on page 6-20 of this manual.

The replaceable parts lists for the OPTION 01 IEEE-488 INPUT PCB ASSEMBLY #05726301 is located on pages 7-42 through 7-47 of this manual.

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